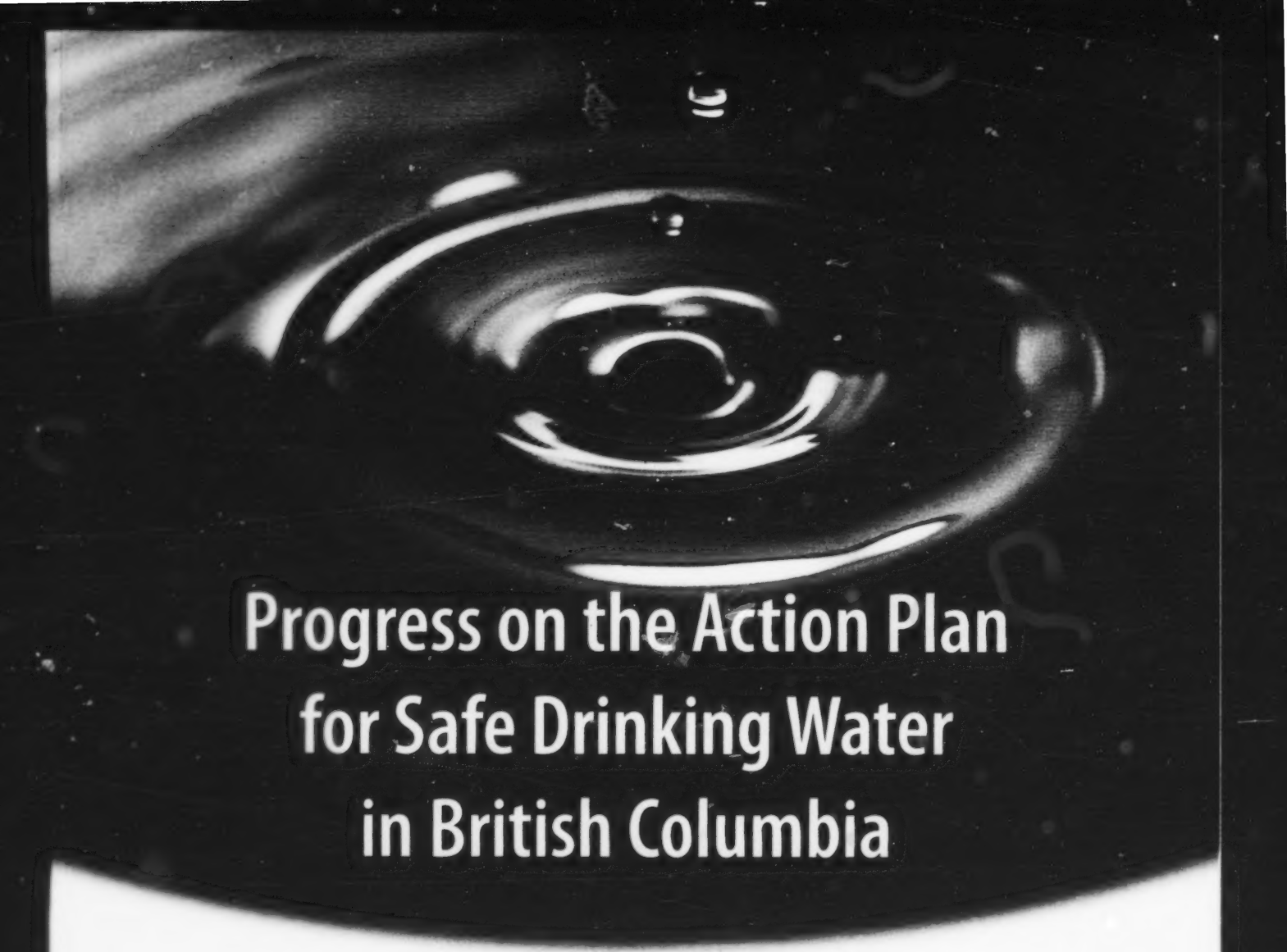

Progress on the Action Plan for Safe Drinking Water in British Columbia

FROM THE OFFICE OF THE PROVINCIAL HEALTH OFFICER

BRITISH COLUMBIA
The Best Place on Earth

Office of the
Provincial Health Officer

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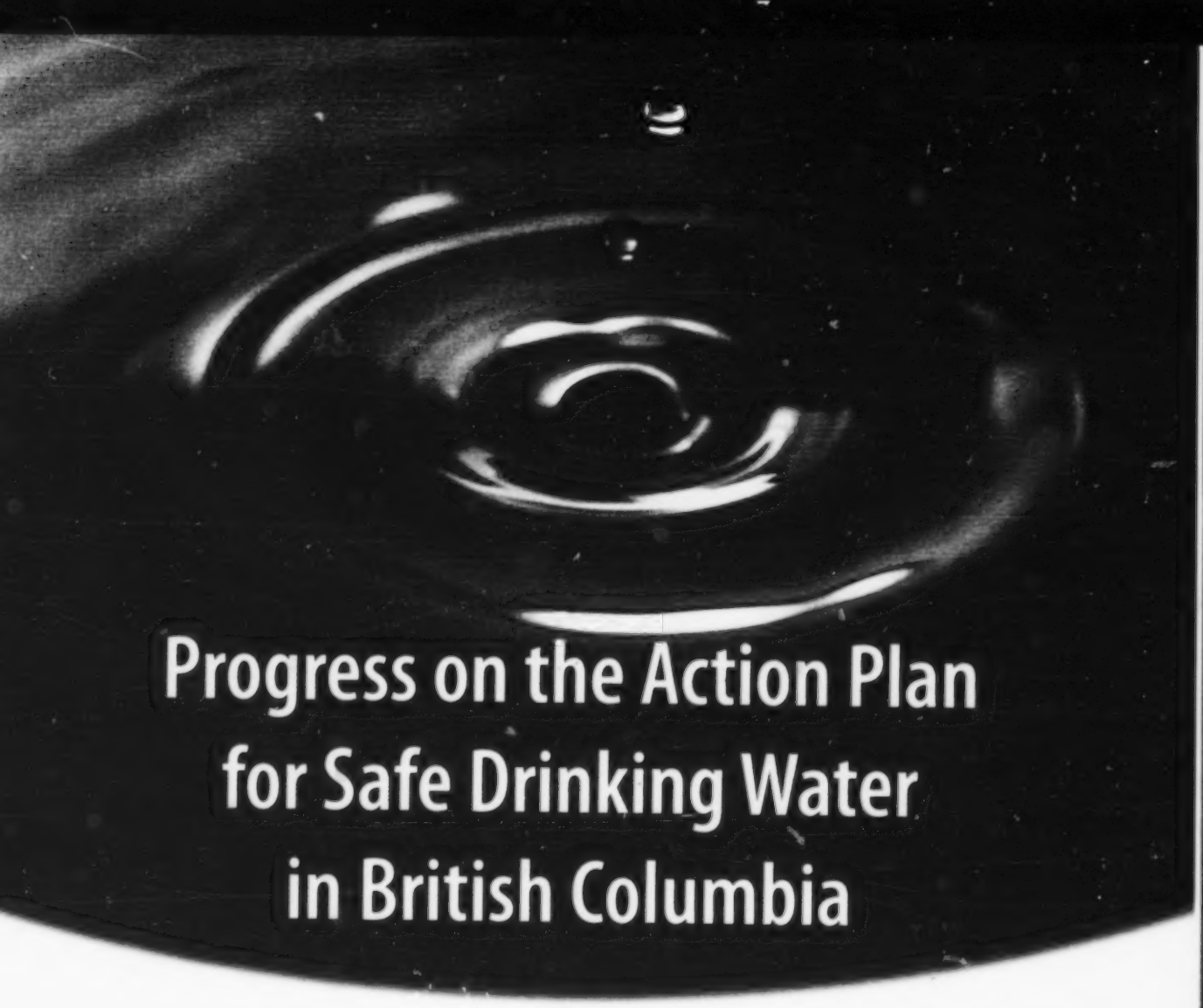

Progress on the Action Plan for Safe Drinking Water in British Columbia

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BRITISH COLUMBIA
The Best Place on Earth

Office of the
Provincial Health Officer

2007-01364/

Ministry of Health
Victoria, BC

February 2007

The Honourable George Abbott
Minister of Health

Sir:

I have the honour of submitting the Provincial Health Officer's report, *"Progress on the Action Plan for Safe Drinking Water in British Columbia"* for the years 2003/2004 and 2004/2005.

P.R.W. Kendall, MBBS, MSc, FRCPC
Provincial Health Officer

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Highlights

Drinking water quality is a public health issue. In 2003, the *Drinking Water Protection Act* came into force and designated the Ministry of Health as the lead agency for drinking water issues within the province. Under Section 4.1 of the Act, the Provincial Health Officer is required to report to the Minister of Health on activities conducted under the Act. This is the first such report. It outlines the provincial government's, health authorities' and water suppliers' activities and accomplishments in this area from May 16, 2003—the day the Act came into force—until March 31, 2005.[1]

The *Drinking Water Protection Act* complements the provincial government's overarching Action Plan for Safe Drinking Water in British Columbia. Together, the action plan and the legislation put in place comprehensive measures, regulations and accountability structures designed to protect drinking water in BC.

While the implementation of the Act and its regulation is still in its early stages, substantial progress was made during the 2003/2004 and 2004/2005 fiscal years. For instance, the five regional health authorities hired an additional 20 public health professionals as specialized drinking water officers. These officers work with water suppliers to implement the Act and regulations and to ensure the requirements are met. One such requirement is for operators who run the province's drinking water systems to be trained and certified. Between 2003 and 2005, 137 new operators met these obligations. In order to support the health authorities in hiring and training drinking water officers, the province has increased the health authorities' base budget by $2 million per year.

The requirements of the Act and regulations are intended to ensure drinking water supplied to the public is potable and meets acceptable quality criteria. These requirements apply to the almost 4,000 public water supply systems in the province. The vast majority of these systems (about 71 per cent) are very small, serving small populations in rural areas. In order to better understand the unique challenges faced by these systems in meeting the requirements of the Act and regulation, the Ministry of Health undertook a review of small systems. The outcomes of this project are detailed in Chapter 7 of this report. To help all water suppliers meet the requirements, the Ministry of Health has developed a number of tools, including best management practices documents (in collaboration with the British Columbia Water & Waste Association), a drinking water screening tool and a guidance document for small systems.

In order to verify that drinking water meets the requirements of the Act and regulation, samples must be tested by laboratories on a regular basis. As a quality assurance measure, the government has set up a process for approving the laboratories that analyse the microbiological quality of water samples. Under this process, the University of British Columbia's Enhanced Water Quality Assurance Program (EWQA) inspects laboratories and works with their staff to ensure tests are carried out in compliance with the *Drinking Water Protection Act* and regulations. The program is based on the principles of peer-review and education. The EWQA then recommends laboratories for approval that meet the criteria and should carry out the microbiological testing of drinking water samples in the province. The final approval of

[1] *Some agencies that provided information for this report collect data on an April 1 – March 31 fiscal year, while some information is reported on a January – December calendar year. Reporting periods are indicated in the text when they differ from May 16, 2003 – March 31, 2004 or April 1, 2004 – March 31, 2005.*

laboratories rests with the Provincial Health Officer. Currently, 15 laboratories are approved. Together, the BC Centre for Disease Control and its contract laboratories test in excess of 75,000 bacteriological samples each year.

In order to determine the effectiveness of the new legislation and activities, the provincial government is in the process of developing performance measures. These performance measures include indicators such as:

- The rate of reported enteric illness in the province.
- The number of public water supply systems in the province under boil water advisories or other forms of public notification.
- The number of public water supply systems with trained and appropriately certified operators versus the number without.
- The number of drinking water supplies in the province that have been assessed for potential health hazards versus those that have not, and the percentage of those that have been assessed that are considered to be at high, medium and low risk.
- The percentages of the population that receive drinking water that does and does not meet the quality requirements set out in the Drinking Water Protection Regulation.

Unfortunately, the data required to report on these performance measures has not historically been collected consistently or reliably across the province. To improve this situation, the provincial government initiated a drinking water information management project in 2003/2004. Led by the Ministry of Health, the project aims to create a comprehensive database that can be accessed and updated by all the government ministries whose activities and responsibilities touch on drinking water, as well as by staff in each of the health authorities and by drinking water suppliers. Ministry of Health staff are developing the definitive core data set which will form the foundation of this ambitious project. Until the project is further along, however, the performance of government and stakeholders in meeting the requirements of the Act and regulation will be measured using information pieced together from a variety of sources. In some cases, the information gathered is difficult to interpret or compare between regions or from year to year. In the two years covered by this report, the Ministry of Health invested more than $600,000 to improve information management.

In addition to these challenges, the government, health authorities and water suppliers face a number of obstacles to fully implementing the Act and regulation. These challenges include:

- Gaps in accountability related to the multiple provincial government ministries whose programs, activities and guiding legislation relate in some way to drinking water, and yet are not coordinated or reliably interactive.
- The lack of routinely collected information about drinking water systems and supplies in the province.
- The multiple and potentially competing ways in which watersheds are used in the province: from wildlife habitat to forestry, mining, agriculture, recreation and development.
- The lack of true accounting of the costs incurred in producing high-quality drinking water, which includes infrastructure costs, training and certifying treatment plant and distribution system operators, monitoring water quality and remediating the effects of pollution.
- The resources needed to access training.
- The sheer number of small water systems in the province.

This report for 2003/2004 and 2004/2005 introduces an accountability framework based on a system recommended by the Auditor General that will help track government's performance in meeting the requirements of the *Drinking Water Protection Act*. This report describes in detail the challenges faced by government in meeting these requirements in 2003/2004 and 2004/2005 and also provides recommendations on how the provincial government, health authorities and water suppliers could overcome these obstacles in order to better protect public health in British Columbia.

Introduction

This document is the first in a series of reports on activities under the *Drinking Water Protection Act* that will be published on an ongoing basis. It describes the activities undertaken by the BC provincial government under the authority of the Act, from the day the Act came into force (May 16, 2003) until the end of the 2004/2005 fiscal year.

This first report includes background information on how the *Drinking Water Protection Act* is administered in BC. It places the activities, progress and accomplishments of the provincial government, health authorities and water suppliers during this period in the context of the eight principles of the Action Plan for Safe Water Drinking Water in British Columbia (Ministry of Health Services, 2002). It also sets the foundation for future accountability reporting, building on an accountability framework developed by the Auditor General and making a series of recommendations to help guide planning and future activities.

This report contains many terms and phrases which may not be familiar to readers. Many of these are defined in the glossary (Appendix E). As well, during the reporting period many government ministries were renamed and/or reorganized. Where appropriate, the current ministry names are used. A guide cross-referencing the names used in 2003/2004 is included at the end of the report (see Appendix G).

History of BC's Drinking Water Regulations

Prior to 1992, drinking water quality in British Columbia was directly regulated under the *Health Act* and its Sanitary Regulation. This regulation prohibited the contamination of source waters and specified set back distances required between sources of contamination and water supplies. In October 1992, the Safe Drinking Water Regulation was brought into force, also pursuant to the *Health Act*, to regulate the construction and operation of waterworks systems. It also required water suppliers to take steps to ensure water was safe to drink.

From 1999 to 2002, a number of organizations, both within and outside of government, issued reports recommending the province strengthen the protection of its drinking water supplies. These reports included:

- *Protecting Drinking Water Sources* (Auditor General of British Columbia, 1999).
- *Drinking Water Quality in British Columbia: The Public Health Perspective*. Provincial Health Officer's Annual Report 2000 (Provincial Health Officer, 2001).
- Final Report: Panel Review of British Columbia's *Drinking Water Protection Act*. (Drinking Water Review Panel, 2002).
- *Waterproof: Canada's Drinking Water Report Card* (Sierra Legal Defense Fund, 2001).

The government considered these reports and recommendations during the development of its current drinking water strategy (2002) and legislation (2001, 2002, 2003).

Action Plan for Safe Drinking Water in British Columbia

In 2002, the provincial government developed an Action Plan for Safe Drinking Water in British Columbia. This plan presents a high-level framework for coordinating the actions of all provincial government agencies that have a role in protecting drinking water quality. The Ministry of Health (then the Ministry of Health Services) was designated the lead agency responsible for implementing the plan.

The Action Plan was designed around eight key principles:

1. The safety of drinking water is a public health issue.
2. Source protection is a critical part of drinking water protection.
3. Providing safe drinking water requires an integrated approach across all the ministries and agencies that have legislated authority for water protection from source to tap.
4. All water systems need to be thoroughly assessed to determine risks.
5. Proper treatment and water distribution system integrity are important to protect public health.
6. Tap water must meet acceptable safety standards and be monitored.

7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Drinking Water Protection Act

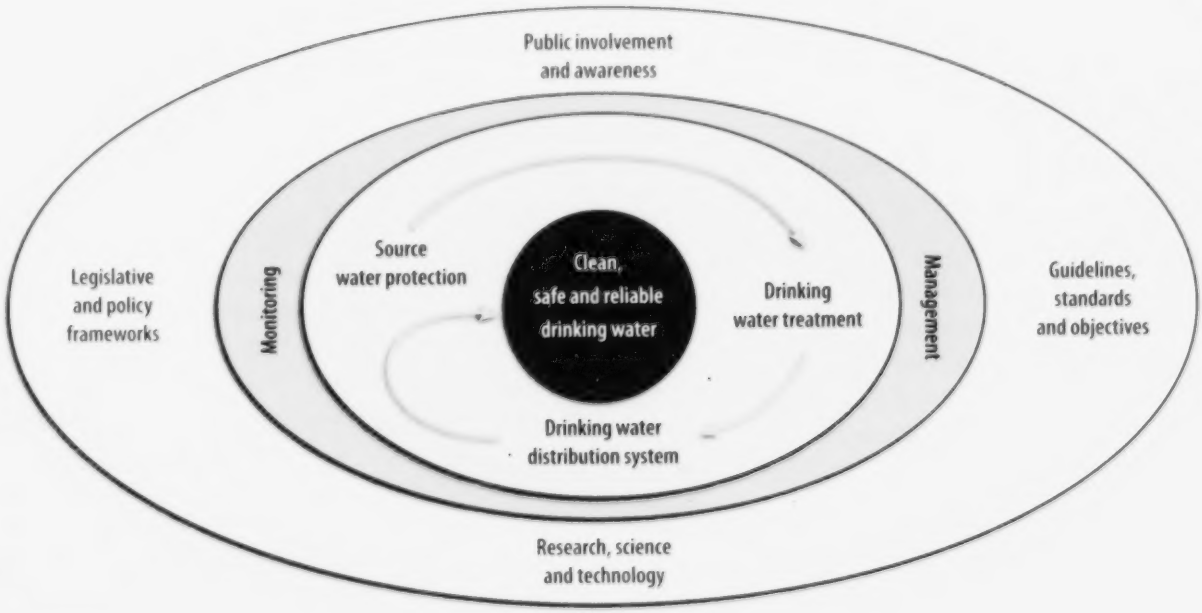
In conjunction with its Action Plan for Safe Drinking Water in British Columbia, the government created the *Drinking Water Protection Act* (DWPA). First passed in 2001, the DWPA was subsequently reviewed and amended before being brought into force in May 2003 along with the Drinking Water Protection Regulation (DWPR).

The DWPA provides a comprehensive, health-based framework for drinking water protection with more emphasis on oversight and accountability than existed under the *Health Act's* Safe Drinking Water Regulation. The new legislation requires public water supply system operators to be certified, clearly enables drinking water officers to require assessments of public water supply systems and includes provisions for developing and implementing drinking water protection plans.

The Act and regulation brought a multi-barrier approach to water safety (see Figure 1). This approach recognizes that drinking water supplies need to be protected in their entirety: from the source water in the watershed or aquifer, through the treatment and distribution systems, all the way to the consumer's tap. Under this "source-to-tap" approach, protection is achieved as a multi-step process. This process includes gathering information about the system through inspections, assessments and water monitoring and then puts barriers in place to stop contaminants from entering the drinking water supply.

BC's multi-barrier approach includes public water supply system assessments, source water protection, water

Figure 1 **The multi-barrier approach to safe drinking water**



Source: From Source to Tap: *Guidance on the Multi-Barrier Approach to Safe Drinking Water*, Federal-Provincial-Territorial Committee on Drinking Water and the Canadian Council of Ministers of Environment, 2004.

treatment, distribution system maintenance and upgrades, water quality monitoring and operator training and certification.

Like its predecessor, the new Act focuses on desired outcomes rather than prescriptive procedures. The Act is administered by knowledgeable health professionals who are able to evaluate the specific needs of an individual public water supply system and exercise their discretionary authority to make decisions. This approach gives local authorities the flexibility to take into account local risks, needs and resources in order to protect public health. For example, rather than requiring water quality to be tested against a long list of mandatory standards—some of which may never apply to a certain water source[1]—drinking water officers can require water suppliers to monitor for chemicals known to be used, or naturally present, in the source water area. The regulation does prescribe microbiological standards that must be met by all public water supply systems, since microbiological pathogens are known to be the key cause of water-related illness in British Columbia.

The following features of the Act help protect public health:

- The Ministry of Health is designated as the lead organization for drinking water issues, strengthening the focus of the legislation on public health.
- Public health officials have the authority and flexibility to determine the safety of drinking water.
- The Provincial Health Officer's role of oversight and accountability is strengthened.
- More responsibility, authority and accountability are placed on the five regional health authorities to ensure the safety of drinking water in their jurisdictions.
- Drinking water officers employed at a local level by the regional health authorities are the key agents overseeing water quality and implementing and upholding the measures of the Act.
- Assessments of public water supply systems are to be conducted by the water supplier, as directed by the drinking water officer, to identify, anticipate and manage potential health risks associated with the system.
- Public water supply systems require non-transferable operating permits.
- Drinking water officers have the authority to place system-specific conditions on those operating permits.
- New owners of public water supply systems must apply for a permit (existing permits are not transferable to new owners), which will help ensure they are aware of the regulations and of the requirements related to their systems.
- Water treatment plants and distribution systems are required to be rated by level of complexity and to be run by operators who are certified to operate them. Long-term staff are not "grandfathered"—they must also become certified.
- Laboratory findings of *E. coli* or fecal coliforms in water supplies trigger the immediate notification of the drinking water officer, medical health officer and water supplier.
- Operational failures that can result in a health hazard must be reported to the drinking water officer.
- Anyone who contravenes the *Drinking Water Protection Act* and its regulation can be severely penalized.

Implementing the Act

In 2003, the government began implementing the Act. However, as with any new legislation, the initial period after enactment has been one of transition and adjustment. More remains to be done to fully implement the new legislation. Minor regulatory amendments may be needed. The following amendments were identified and with the exception of clarifying the role of the public health engineer in issuing construction permits and transferring provisions of the Health Act Fees Regulation to the Drinking Water Protection Regulation, were addressed by regulatory amendment in 2005[2]:

[1] Regular arsenic testing is not necessary in places where there is no history of the contaminant in the water nor any arsenic-bearing rock formations that could leach arsenic into the water supply. Conversely, where arsenic is of concern, suppliers may be required to focus monitoring on the effectiveness of their treatment processes to reduce arsenic levels at the tap.

[2] Amendments made to the Drinking Water Protection Regulation became effective December 31, 2005. The amended regulation is available online at: http://www.qp.gov.bc.ca/statreg/reg/D/200_2003.htm

- Establish a definition of "small system."
- Create flexibility for certification requirements where small systems require minimal operation.
- Expand treatment options available to small systems owners.
- Create flexibility in water quality standards where small systems do not provide water for consumption or food preparation.
- Clarify that individual public buildings connected to a regulated water supply system do not require additional permitting or operator certification.
- Clarify the role of the public health engineer as the drinking water officer approved to issue construction permits.
- Remove the option for water suppliers to test for fecal coliforms, making it mandatory to test samples for *E. coli* in addition to total coliforms.
- Ensure laboratories can be required to report all water sample results, including information about samples that will not be analysed because too much time has passed between collection and receipt by the laboratory, to the drinking water officer and/or the water supply owner.
- Provide greater flexibility for uncertified specialists to maintain or repair a water supply system, provided they do so in accordance with procedures approved by a certified individual.
- Clarify that bottled water manufacturers and bulk water dispensing machines are excluded from the requirements of the *Drinking Water Protection Act*.[3]
- Transfer provisions of the Health Act Fees Regulation to the Drinking Water Protection Regulation.
- Establish ticketing provisions under the *Offence Act* for significant violations of the DWPA or regulation.

In addition, new relationships are being formed between the government agencies involved with drinking water issues and new policies and assessment tools are being created. Drinking water officers, water suppliers and operators are being trained and given further education opportunities. Details about these relationships and activities are provided throughout the report.

Accountability

Accountability Framework

As the Auditor General of BC noted in landmark reports in 1995 and 1996, accountability entails more than simply reporting activities. It requires having clear objectives, monitoring and evaluating measurable performance targets and reporting the outcomes as gauged against those objectives and measures. These actions make it possible to chart progress. If actions and strategies are not producing the desired results, steps can then be taken to address deficiencies. Goals and strategies can be adjusted.

The framework illustrated in Figure 2 is taken from the 1996 Auditor General's report, *Enhancing Accountability for Performance: A Framework and an Implementation Plan*. This dynamic framework of continuous quality improvement and accountability involves setting clear goals and objectives, establishing strategies to meet those objectives, aligning management systems to implement the strategies and then measuring performance and reporting the results. If the objectives have not been met, consequences follow.

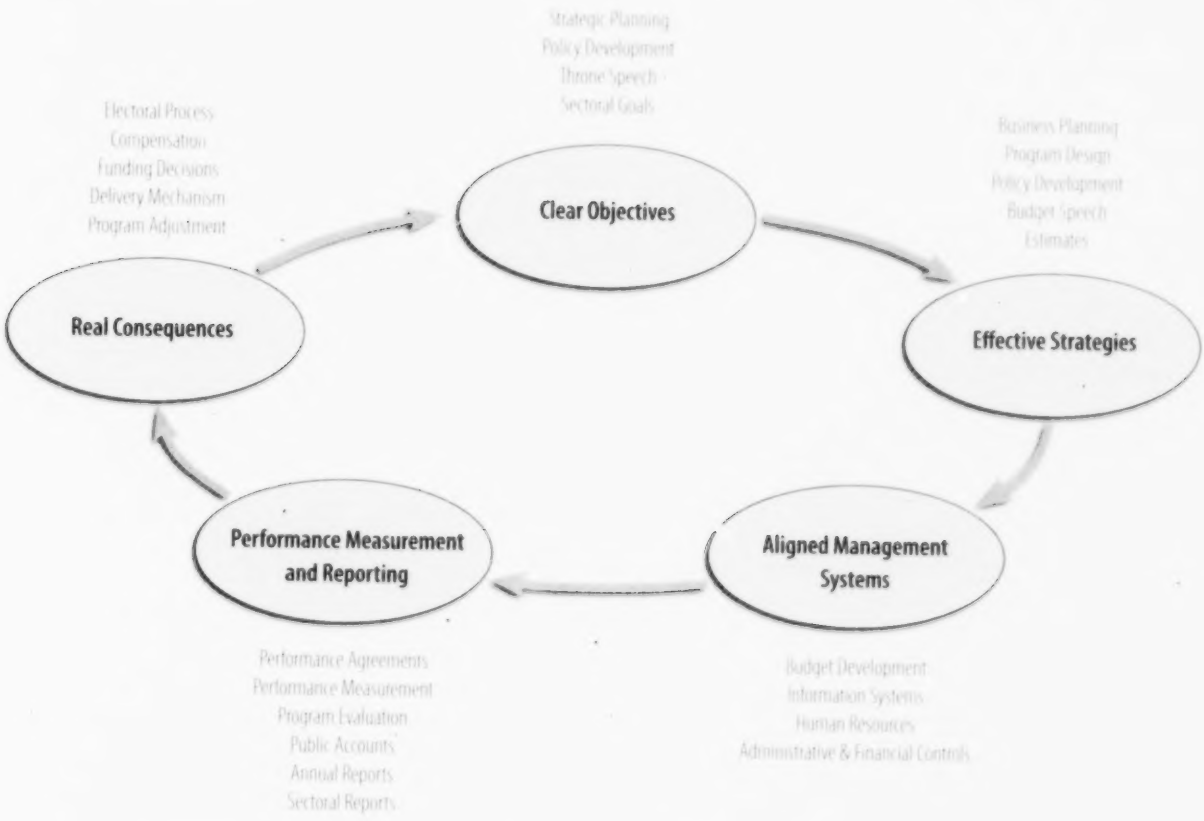
Figure 2 is adapted in each section of this report to describe what the government, including the five regional health authorities, has been doing to address each of the eight principles set out in the Action Plan for Safe Drinking Water in British Columbia. The "clear objective" for each section is the appropriate principle. The "effective strategies" are the parts of the *Drinking Water Protection Act* and its regulation, as well as other supporting programs and policies, associated with the principle in question. The "aligned management systems" relate to the information and management systems, human resources and budgets in place. "Performance measurement and reporting" refers to tools such as this report that describe what has been accomplished to date and what remains to be done, in order to help decision makers

[3] *They remain subject to the Food Premises Regulation under the* Health Act *and the federal Food and Drug Regulations, Division 12.*

assess whether changes or adjustments need to be made. These adjustments form the "real consequences." In this report, the consequences are presented as recommendations. They may include amendments to legislation, the development of policies or guidelines to support decision makers or water suppliers, improvements to water system infrastructure, other adjustments to government's strategies and systems needed to meet objectives, or the development of improved performance measures.

This accountability structure, as applied to safe drinking water, is still in its early stages and cannot yet be fully realized in this first report. Government is only beginning to establish agreed-upon performance measures. This work is being conducted through the drinking water information management project, which includes an analysis of the business requirements needed to administer the *Drinking Water Protection Act*. Once completed, the project will identify what information needs to be collected to evaluate activities under the Act and to effectively report back to the Legislative Assembly and the public (See Section 3.3.2 for more information on this project). Future reports will continue to track this progress.

Figure 2 **Accountability framework**



Source: *Enhancing Accountability for Performance: A Framework and an Implementation Plan*. Auditor General of British Columbia, 1996.

Who is Accountable for the Safety of Drinking Water in BC?

Details about accountability related to each principle of the Action Plan for Safe Drinking Water in British Columbia are given in the corresponding chapter of this report.

Administration of the *Drinking Water Protection Act*

The Minister of Health is ultimately responsible for ensuring that the DWPA is applied throughout the province and that staff and other resources are available to administer the legislation.

Routine administration of the Act is the responsibility of drinking water officers and their delegates hired by the five regional health authorities. While these statutory decision makers work for regional health authorities, their powers and responsibilities flow directly from the Act. It is important to note that while health authorities are responsible for ensuring resources are available to drinking water officers, they have no authority over the officers' role nor can they restrict the officers' statutory discretion.

The five regional health authorities are the Interior Health Authority, the Fraser Health Authority, the Vancouver Coastal Health Authority, the Vancouver Island Health Authority and the Northern Health Authority. Their boundaries are shown on the map in Figure 3. In addition to the five regional health authorities, the Provincial Health Services Authority coordinates those services that provide province-wide coverage, such as the British Columbia Centre for Disease Control (BCCDC).

The Act specifically names medical health officers appointed under the *Health Act* as drinking water officers. The medical health officers, in turn, have the power to either appoint other people as drinking water officers or to delegate the powers of the drinking water officer to others as they see fit. To date, medical health officers have appointed as drinking water officers, or delegated some or all of their duties to, public health inspectors and professional engineers hired by the health authorities. The Minister of Health can also appoint others to the position of drinking water officer, but no such appointments were made in 2003/2004 or 2004/2005.

Regardless of whether a person has been appointed as a drinking water officer or has had duties delegated to him or her, s/he has full authority under the Act. Moreover, the person who did the appointing or delegating cannot restrict the delegated official's discretion. In other words, a person who has been delegated the powers of a drinking water officer holds those powers in the very same way as the person who delegated them.

In the event that a statutory decision maker is found to be acting irresponsibly in exercising his or her authority, this authority can be removed. S/he can be removed from a particular file if there is evidence that s/he is biased in relation to a particular case. No such action was deemed necessary in either 2003/2004 or 2004/2005.

In addition to the responsibilities under the DWPA, medical health officers have both responsibilities and accountabilities under the *Health Act*. If the Provincial Health Officer believes that a medical health officer is failing to address a health hazard, she/he is empowered to order the medical health officer to take appropriate action. This authority extends to drinking water health hazards and can be addressed under provisions of the *Health Act*. No such orders were found necessary in either 2003/2004 or 2004/2005.

Under Section 4.1 of the Act the Provincial Health Officer must prepare an annual report respecting activities for the past year. The current report covers fiscal years 2003/2004 and 2004/2005, the first two years after implementation of the Act and its regulations. The lack of integrated electronic information systems has made collection of useful information slow and laborious. It is anticipated that better information technology in the future will facilitate the production of these reports.

Under Section 4.2 of the Act, the Provincial Health Officer also has a duty to report to the Minister of Health matters that may interfere with the effective administration of the Act or that may potentially conflict with the Act. In the event that such matters are brought to his or her attention, the Minister has a number of avenues available to address them.

Figure 3 **Map of health authorities and health service delivery areas in British Columbia**

Source: *Drinking Water Quality in British Columbia: The Public Health Perspective. Provincial Health Officer's Annual Report 2000.* Provincial Health Officer, October 2001.

First, the Minister has the power under Section 4 of the Act to require drinking water officers to follow directives or to consider guidelines in exercising their powers. For instance, in response to a situation in January 2004 where a water supplier failed to comply with a public notification order, the Minister directed health authority staff to ensure expeditious follow-up on such orders.[1]

Second, where a matter brought to the attention of the Minister is related to activities under the jurisdiction of another government ministry, the Minister of Health can take this issue to the appropriate minister for consideration. Actions considered should fit with government's commitment to cross-governmental coordination under the Action Plan for Safe Drinking Water in British Columbia. In 2003/2004 and 2004/2005, no issues were identified that required the Minister of Health to follow-up with another Minister.

External to the DWPA, the Assistant Deputy Ministers' Coordinating Committee on Drinking Water[2] and the Directors' Inter-Ministry Committee on Drinking Water have taken steps to ensure that mechanisms are in place to coordinate government activities related to drinking water. In 2003/2004 and 2004/2005, these committees addressed cross-jurisdictional issues related to the sale of Crown lands, lease lots in drinking water supply watersheds, and drought-related management concerns.

Accountability for Water Quality

Figure 4 shows how reporting takes place on activities related to drinking water. Some of the reporting is required by legislation while some is a matter of policy (such as reports to the Ministry of Health by other ministries). The DWPA makes water suppliers accountable for the quality of water provided to consumers. Water suppliers can be private individuals, partnerships, corporations, improvement districts, local governments or societies. In addition, the individuals acting on behalf of the water supplier may be personally accountable for complying with the legislation, particularly if they fail to act in good faith.

The drinking water officers from each of the health authorities report to the Ministry of Health and to the Provincial Health Officer. They may also receive instruction from the Minister of Health. The drinking water officer is responsible for:

- Overseeing the approval of plans for new and existing waterworks systems, issuance of permits, inspections, water quality monitoring, investigation of non-compliance with legislation and investigation of waterborne disease outbreaks.
- Providing technical expertise on water quality.
- Communicating the state of water quality to the Provincial Health Officer, the Minister of Health and the public.

Ministry of Health staff and the Provincial Health Officer report to the Minister of Health, who reports to the legislative assembly. The legislative assembly, in turn, is accountable to the public. Both the Minister and the Provincial Health Officer also report directly to the public.

Laboratories performing water quality testing under the Act have a number of responsibilities, including obtaining approval from the Provincial Health Officer to test for the parameters outlined in Schedule A of the DWPR and reporting positive fecal coliform or *E. coli* results immediately to the water supplier, medical health officer and drinking water officer.

Where an individual, water supplier or laboratory fails to comply with a requirement of the Act or regulation, they may be liable for a fine of up to $200,000, imprisonment for up to one year and creative sentencing.[3] The same penalties also apply to a person who tampers with a domestic water system (including a system serving a single family dwelling) or contaminates a water source. No such charges were laid during 2003/2004 and 2004/2005.

[1] This directive was subsequently rescinded in March 2004. It was replaced by a broader directive to drinking water officers to consider the Drinking Water Officers' Guide, *which provides comprehensive protocols for issuing, following up on and rescinding orders under the* Drinking Water Protection Act. *See Section 1.3.1 for further details.*

[2] See the Assistant Deputy Ministers' Committee on Water.

[3] A wide range of latitude is available to allow sentences to reflect the nature of the offence. For example, a corporation found guilty of contaminating a water source could be required to engage in activities to educate other companies about the need to protect water sources.

Figure 4 **Communication relationships for accountability on drinking water issues in British Columbia**

Complaints Under the Act

The DWPA provides a number of avenues for addressing concerns raised about decisions that affect water quality. First, under Section 39.1 of the Act, certain decisions made by a drinking water officer may be reconsidered and, if not addressed, can be subsequently reviewed by the Provincial Health Officer. If this process is found to be unsatisfactory, the affected party can initiate a judicial review or take the issue to the Office of the Ombudsman for investigation.

A second route for addressing complaints is offered under Section 29 of the Act. This section allows anyone who thinks their drinking water is being threatened to request, in writing, that a drinking water officer investigate the situation. The drinking water officer, in turn, must respond to the request in writing.

In 2003/2004 and 2004/2005, no requests for reconsideration or review were received by drinking water officers nor were any requests for investigation made that specifically cited Section 39.1 of the Act. That said, a number of complaints were received from water supply owners, water system operators, owners of domestic water systems and customers of water supply systems. These complaints were made both verbally and in writing to drinking water officers, the Provincial Health Officer and the Minister of Health.

These complaints related to:

- Water quality.
- Logging activity adjacent to water sources.
- The presence of cattle near the drinking water intake works.
- The failure of water suppliers to provide adequate treatment.
- The failure of water suppliers to provide public notice of poor water quality.
- The sale of Crown land lease lots located adjacent to water reservoirs.
- Mining activity in watersheds.
- Requirements for operator certification.
- Requirements for water treatment infrastructure improvements.
- Concerns that water supply owners were not maintaining adequate staffing levels.

In response to these complaints, drinking water officers conducted on-site inspections and reviewed records. In one case, a drinking water officer issued a hazard abatement order against a land owner requiring cattle to be removed from property adjacent to a water intake. In several cases, insufficient evidence was available to determine whether or not a health hazard existed and water suppliers were required to conduct assessments to provide more information. In addition, the sale of many Crown land lease lots has been delayed or deferred, pending evaluation of the likely impact the changes in ownership might have on water quality. Reviews of referral processes between government officials have also been undertaken.

Operator certification requirements have been a common cause of complaint. Many water suppliers and operators have expressed concerns about their ability to access the training needed to achieve certification. Water suppliers, particularly owners of smaller public water supply systems with minimal operational needs, have complained that the requirements are too stringent. Very large water suppliers have also raised concerns since their staff include engineers and other professionals with skill sets relevant to the operation of the system but who are not technically considered "operators." While they are therefore not certified, their skills complement those of the certified operators.* For more information on operator training and certification, see Chapter 5.

In response to these complaints, water suppliers and operators were surveyed in 2003/2004 and a broad review of the needs of small water systems was undertaken. This review included a focus on small water system operator qualifications.† Reports from this project will be posted at http://www.health.gov.bc.ca/protect/dwpublications.html. For more information on small systems, see Chapter 7.

Some suppliers have requested recognition of this expertise as contributing to the requirement for certified operators.

†*The Drinking Water Protection Regulation was amended in December 2005 to provide greater flexibility for operator requirements for systems serving fewer than 500 people in a 24-hour period.*

Performance Measures

Collecting meaningful and relevant data about the thousands of public water supply systems in BC is a daunting task. To date, efforts to manage and monitor provincial drinking water issues have been hampered by the lack of basic, easily-accessed, centralized data and the lack of coordinated information gathering. These data are essential for establishing the state of drinking water quality in the province and for tracking progress under the *Drinking Water Protection Act*.

In order to address some of these challenges, the Ministry of Health has led a drinking water information management project under the direction of the Directors' Inter-Ministry Committee on Drinking Water. The project has been guided by a multi-agency Technical and Business Steering Group, with advice and guidance from stakeholders, the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Drinking Water Leadership Council.[1]

The project is intended to support decision making and accountability and to help public water supply systems operate more effectively. It will also provide industry with access to data that will give them greater awareness of where water supplies are located to help them with responsible land use planning. For more information about this project, see Section 3.5.2.

[1] *This project is now being led by the Ministry of Environment.*

1. Public Health Protection

1.1 Context

Clean and safe drinking water is important to the health and wellness of British Columbians.

BC is blessed with an abundance of mountain lakes and streams. Our access to these apparently pristine sources of drinking water makes it easy to think they are free of contaminants and therefore in no need of treatment. However, it takes as little as a beaver or muskrat living in the watershed to contaminate a water supply. Logging, cattle grazing, outdoor recreation, agriculture and other human activities in a watershed can also adversely impact water quality.

In recent years, outbreaks of waterborne illness in many jurisdictions have highlighted the need to be vigilant in order to ensure drinking water supplies are safe. For instance, in 2000, an *E. coli* and *Campylobacter* outbreak in Walkerton, Ontario, killed 7 people and infected an estimated 2,700 more. A year later, a waterborne outbreak of cryptosporidiosis in North Battleford, Saskatchewan, infected an estimated 5,800 to 7,100 people (Laing, 2002). Both of these outbreaks attracted extensive media attention. Anecdotal reports from health officers indicated that general public opinion and awareness of water quality issues substantially changed as a result. Waterborne illness is finally being understood by the public as not just the temporary inconvenience of an upset stomach, but rather as a potentially serious public health risk that could cause severe illness or, occasionally, death.

1.1.1 Outbreaks of Waterborne Illness in BC

Disease Surveillance

A number of disease surveillance programs are in place in British Columbia to identify outbreaks and evaluate background incidence of illness. Procedures are in place to respond to and manage outbreaks.

The Health Act Communicable Disease Regulation requires physicians and other health practitioners to report on a wide range of diseases. While a limited number of diseases (such as toxoplasmosis and cryptosporidiosis) are specifically named in a schedule to the regulation, the regulation requires all bacterial, viral and parasitic gastroenteritis epidemics and all cases of waterborne illness to be reported.

The British Columbia Centre for Disease Control's (BCCDC) Epidemiology Services carries out disease surveillance. Using the Public Health Information System of electronic surveillance, the centre works closely with regional health authorities to analyse and monitor communicable disease information. As part of the Canadian Field Epidemiology Program, field epidemiologists working with the BCCDC are available to help medical health officers respond to disease investigations.

Disease outbreaks can be initially identified by a number of formal and informal processes. In addition to communicable disease reports by physicians, pharmacists have occasionally provided early indications of outbreaks by reporting increased demand for over-the-counter diarrhoea medicines. The 1997 viral outbreak in Princeton was brought to the attention of the area public health inspector by conversations with people

Health Risks Associated with Drinking Water

Microbiological pathogens: Disease-causing bacteria, protozoa and viruses can potentially contaminate water supplies anywhere from source to tap. Bacteria such as *E. coli* and *Campylobacter*, and protozoa such as *Giardia* and *Cryptosporidium*, are found in human and animal feces. They can end up in water supplies contaminated by sewage or by animals in the watershed. Infectious agents that cause norovirus, and hepatitis can also be carried in water contaminated with human fecal waste. In BC, the protozoan parasites *Giardia* and *Cryptosporidium*, resistant to chlorination, have been responsible for more than half of the 29 reported outbreaks of waterborne disease in the last two and a half decades. The bacteria *Campylobacter* has been responsible for six outbreaks. Testing for these pathogens is expensive and can be unreliable, so fecal coliforms or *E. coli* are used as indicators to show whether the water contains human or animal feces that may potentially be harbouring other pathogens.

Chemical contaminants: Chemicals can enter a water supply from natural sources or from human activities. Naturally occurring elements, such as arsenic and uranium, can leach from bedrock into wells and aquifers. If these elements appear at high levels and are consumed over long periods, they could present a health risk. In BC, naturally occurring arsenic can be a problem for groundwater sources. Arsenic has been detected at elevated levels in the Sunshine Coast and in locations scattered around the province. Agricultural activities can introduce nitrates from fertilizers or pesticides into shallow aquifers or poorly protected wells. Spills of industrial chemicals or petroleum products can contaminate water supplies. Contaminated sources can be lost for future use.

Turbidity: Cloudiness in water, usually caused by suspended organic or inorganic matter, can undermine water quality, interfere with treatment processes and decrease the aesthetic value of the water. It is usually a seasonal issue caused by sudden snow melt or extreme rainfall, resulting in stream bank erosion, surface run-off, landslides or other events that carry materials into the water. Increased turbidity in water supply systems has been shown to correlate with an increased incidence of infectious gastrointestinal illnesses.

Disinfection by-products: Dissolved organic matter in water — from sources such as decomposing leaves — can react with chlorine or other disinfectants and create by-products such as trihalomethanes. Long-term exposure to high levels of disinfection by-products has been associated with some types of cancers in a small percentage of the population. Recent evidence also suggests that there may be reproductive effects from exposure to high levels of the disinfection by-product, bromodichloromethane (BDCM). BDCM which is uncommon in British Columbia, because bromine is not commonly found in water sources in the province. The one water system in the province with BDCM at levels approaching the national guideline is taking steps to reduce concentrations. It is important to remember that the potential effects from disinfection by-products are generally recognised as being of secondary concern to the known and immediate health threats associated with not disinfecting drinking water — those that come from ingesting microbiological pathogens.

For more information and discussion about these and other health risks in drinking water please refer to the 2000 Provincial Health Officer's Annual Report, available online at http://www.healthplanning.gov.bc.ca/pho/pdf/phoannual2000.pdf

in the community who commented on the large number of people who were ill.

While reports of illness in a community have proven effective in identifying waterborne outbreaks, they suffer from well known deficiencies. Incubation periods for waterborne diseases may vary from days to weeks; then, in order for a disease to be reported, the person must see a physician, the physician must order a laboratory test and, finally, the result must be reported to public health authorities. Currently, cases are significantly under-reported. New approaches to more timely public health surveillance are being studied and include surveillance of over-the-counter diarrhoea medicine sales, reviews of medical services plan billings for physicians treating patients for diarrhoea and tracking the number of calls to the BC NurseLine related to diarrhoea.

In each of these approaches personal data, which would identify individuals, are not available to the public health officials involved, to ensure that patient privacy rights are protected.

BCCDC has employed additional surveillance methods during waterborne outbreaks in BC communities. These include: (1) establishing sentinel clinics to monitor rates of gastrointestinal illness in physicians' practices; (2) monitoring diarrhea rates in long-term care facilities; and (3) surveys of community residents to estimate diarrhea rates. Each of these surveillance methods has strengths and weaknesses (e.g., timeliness, sensitivity, specificity, acceptability). Ideally a combination of methods would be employed.

Outbreaks

Between 1980 and 2004, BC had one of the highest reported numbers of waterborne disease outbreaks in Canada: 29 confirmed outbreaks that affected tens of thousands of British Columbians (see Table 1). According to BCCDC, the 1996 cryptosporidiosis outbreak in Kelowna alone resulted in an estimated 10,000 infections. Many of the outbreaks resulted from water system failures or inadequate treatment.

Table 1: Key outbreaks related to drinking water in BC 1995-2004

Year	Outbreak
1995	Toxoplasmosis in Victoria; 110 infections confirmed, estimated 3,000 infected. Source: Assumed cats or cougars in watershed.
1996	Cryptosporidiosis in Cranbrook; 29 infections confirmed, estimated 2,097 households contained at least one resident with diarrhea. Source: Cattle in watershed.
1996	Cryptosporidiosis in Kelowna; 177 infections confirmed, estimated 10,000 infected. Source: Not confirmed but believed to be contamination of water by human sewage.
1997	Norwalk-like virus in Princeton; 88% of service area affected. Source: Sewage main break that contaminated a well.
1998	Cryptosporidiosis in Chilliwack; 19 infections confirmed. Source: Animals in the watershed. Campylobacteriosis in Sunshine Coast; 26 infections confirmed. Source: Unknown, but probably wildlife in the watershed. The supply was not disinfected and a boil water advisory was in place.
2002	Suspected waterborne campylobacteriosis outbreak in Langdale.
2004	Campylobacteriosis in Hagensborg; 5 infections confirmed. Source: Wildlife suspected. Untreated surface water with a boil water advisory in effect at the time of the outbreak.

In addition to confirmed or suspected outbreaks, situations are periodically identified which pose unacceptable risks to consumers. For instance, between 2003 and 2005, the following observed conditions could have increased risk to consumers:

- Inadequate treatment of some surface water supplies used as the source of drinking water.
- The presence of contaminant sources adjacent to water supply intakes.
- Unqualified operators running public water supply systems.
- A water supplier failing to issue a public advisory when ordered to do so by a drinking water officer.
- Cross-connections with non-potable water sources.

1.1.2 Public Notification

Under the *Drinking Water Protection Act* (DWPA), water suppliers are legally responsible for notifying the public of water quality concerns or problems. In addition, the DWPA requires all water suppliers to have an emergency response and contingency plan, including a process to rapidly notify all customers in the event of a health hazard associated with drinking water. Water suppliers can act independently or under orders from their drinking water officers.

Water Advisories

One form of public notification is an advisory issued to consumers. Advisories alert consumers to the fact that their drinking water supply may be contaminated. The contamination could be chemical or microbiological in nature. Consumers may need to use an alternate supply of drinking water until the problem is fixed. If the contamination is severe and persistent, the community may need to find a new permanent drinking water supply.

Chemical contamination of a water supply can stem from natural sources, such as bedrock that has high concentrations of uranium or arsenic, or from human activities, such as agricultural or industrial practices. BC has been affected by both. For instance:

Advisory for People with Compromised Immune Systems

The Provincial Health Officer has issued an ongoing advisory to people with compromised immune systems. Because no water supply is 100 per cent safe, and sudden water quality failures can take hours or even days to identify and communicate to an entire community, people who have HIV/AIDS, are undergoing chemotherapy or who have compromised immune systems are advised to consider boiling their water, or installing an in-home drinking water treatment device capable of reducing their risk of illness. Systems that filter and disinfect with reverse-osmosis or ultra-violet light technology are readily available and, when properly used and maintained, can provide an effective safeguard against distribution system or treatment failure.

- Arsenic is commonly found at levels of concern in groundwater supplies in some areas of the province. Information about some locations where arsenic has been detected is available at http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/ground_fact_sheets/index.html (Note: Information on this site is being updated to reflect a new Canadian drinking water guideline for arsenic.)
- In the summer of 2003, water from a new well drilled in Summerland was found to have elevated levels of elemental uranium. In order to meet the *Guidelines for Canadian Drinking Water Quality*, the water was blended with other source water prior to distribution to the community.
- In the early 1990s, the water supply in Heffley Creek, BC, was contaminated by salt from a winter road sand stockpile. The contamination clean-up included acquiring property for new well sites, drilling replacement wells, remediating contaminated soils, paying damage claims, monitoring groundwater quality and modeling plume dispersion, replacing water pipes corroded with salt, supplying bottled water to residents, holding public

meetings, paying legal fees and relocating and protecting the sand stockpile. The total cost of responding to the contamination was close to $2 million whereas the cost to construct a suitable storage facility that would have prevented the contamination in the first place (as was done subsequent to the contamination) was approximately $250,000.

Boil Water Advisories[11]

If drinking water is known or suspected to be contaminated by microbiological pathogens, individuals may be advised to boil or otherwise disinfect their water before consumption. Alternatively, they may be advised to use a different source of drinking water. The advisory may be given by a water supplier, the medical health officer or the drinking water officer if:

- *E. coli*, fecal coliform or total coliform bacteria are present in the water supply in greater amounts than the limits prescribed in the Drinking Water Protection Regulation.
- Drinking water from a surface water source or from shallow wells is not disinfected.
- An elevated health risk exists because of a treatment or distribution system failure.
- Evidence exists of improper or irregular operation or maintenance of a public water supply system.
- High turbidity exists in source or supplied waters.
- A waterborne disease outbreak has been confirmed or reports of gastrointestinal illness raise suspicions of a possible outbreak.

Boil water advisories are usually temporary but may last for weeks, months or years if a situation is not addressed. Long-term boil water advisories are generally only in effect on small water systems.

Number of Boil Water Advisories in BC

Over the last five years, the number of boil water advisories increased in the province. In December 2000, 220 of the nearly 4,000 public water supply systems on record in BC (not counting those in First Nations communities), were under boil water advisories.

By August 2001, the number of advisories jumped to 304, or to about 7.5 per cent of public water supply systems in the province. By November 2003, the number of boil water advisories in BC had climbed to 393 (or approximately 10 per cent of systems).[12] This sudden increase did not correspond to a rise in contaminated water. Rather, the criteria that triggered a public notification or advisory had become more stringent, monitoring improved, water suppliers became more aware of the need to report treatment failures and small water systems with inadequate treatment that had been unknown to

Water System Lifts 10-Year Boil Water Advisory

The small community of Devine, north of Pemberton, had been on a boil water advisory for almost 10 years because of repeated tests showing total and fecal coliforms in Spruce Creek, the community's water supply.

With just 35 connections, the community had access to a limited revenue base to fund water system improvements. Under the Canada-BC Infrastructure Program, the community was awarded $79,000 towards the $128,000 cost of tapping into a local aquifer recharged by Spruce Creek through an alluvial fan that acts like a natural filter. The water in the aquifer meets all the criteria of the *Guidelines for Canadian Drinking Water Quality*.

With additional funds from the Squamish-Lillooet Regional District, each household in the community paid $250 a year—less than a dollar a day—over five years. The community now accesses safe, high quality water and the boil water advisory was finally lifted in March 2004.

[11] *The procedures for notifying the public under the* Drinking Water Protection Act *have been clarified since the Act came into effect in 2003. There is now a process for issuing "water quality advisories," "boil water notices" and "do not use water notices." This process is outlined at http://www.healthgov.bc.ca/protect/pdf/dwguide.pdf. For the purposes of this reporting period, all public notifications to consider steps to boil water are reported as "boil water advisories."*

[12] *Note that the specific reasons why an advisory is issued for a particular water supply are not yet collected in computerized systems. This type of data will be collected as part of the province's drinking water information management project (see Section 3.3.2).*

drinking water officers were being discovered and inspected, and risk factors identified. Where appropriate, warnings were being issued. Short-term notifications and advisories became more common than they once were. Most of these advisories affected very small systems. An estimated 65 per cent of these advisories were issued to communities relying on untreated surface water which did not meet the microbiological schedule of the Drinking Water Protection Regulation.

Following the promulgation of the DWPA in May 2003, drinking water officers began re-evaluating programs that provide public awareness of water quality problems. As public notification procedures have changed, the value of tracking counts of boil water advisories as a means of assessing overall performance of drinking water programs has become questionable.

Tracking counts of boil water advisories can also be misleading since the proportion of systems under advisories does not reflect the proportion of the population affected. Most of the long-term advisories are on public water supply systems with 1 to 300 connections and are estimated to serve about 1 per cent of the total BC population. The focus on reducing the count tends to undermine the fundamental purpose of the advisory, which is to inform specific communities about their water quality concerns. Nevertheless, it is clear that more can be done to reduce the need for boil water advisories in the province and to minimize reliance on individual households boiling their water as a *de facto* form of water treatment.

Long-Term Considerations

Issuing advisories on a regular basis can desensitize people. Concern has been raised that advisories issued in an "on-again, off-again" manner or for extended periods of time can result in complacency. Many surface water sources in British Columbia contain few pathogens and communities that rely on these sources without treatment may not experience a noticeably high incidence of gastrointestinal illness. In the face of a long-term boil water advisory without apparent community-wide illness, many people may not take added precautions with their drinking water. However, when water does become contaminated—which can result from something as simple as a beaver taking up residence near the intake works, as happened in Revelstoke in 1995—a high proportion of the population can become ill from ingesting pathogens.

In those areas where people may be exposed to elevated risks for long periods of time pending infrastructure upgrades, drinking water officers and water suppliers need to ensure that public education programs are in place to support the public notification programs.

1.2 Accountability

The first principle of the Action Plan for Safe Drinking Water in British Columbia recognizes that the safety of drinking water is a public health issue. Because of this, the Ministry of Health has been identified as having the lead for drinking water quality in BC. This approach differs from most other provinces where drinking water is regulated by an environment or resource ministry. Having health officers lead the administration of drinking water legislation greatly facilitates a regulatory framework that focuses on health-based outcomes. Drinking water officers in the five health authorities are health officials and work in a coordinated team composed of the regional medical health officer, public health engineers and public health inspectors (also known as environmental health officers). Water system operators generally work closely with this team as they ultimately share common goals and motivations.

Figure 5 shows how the accountability framework discussed in the introduction applies to this first principle. Progress and accomplishments related to each component are discussed in Section 1.3.

Figure 5

Principle 1: The safety of drinking water is a public health issue

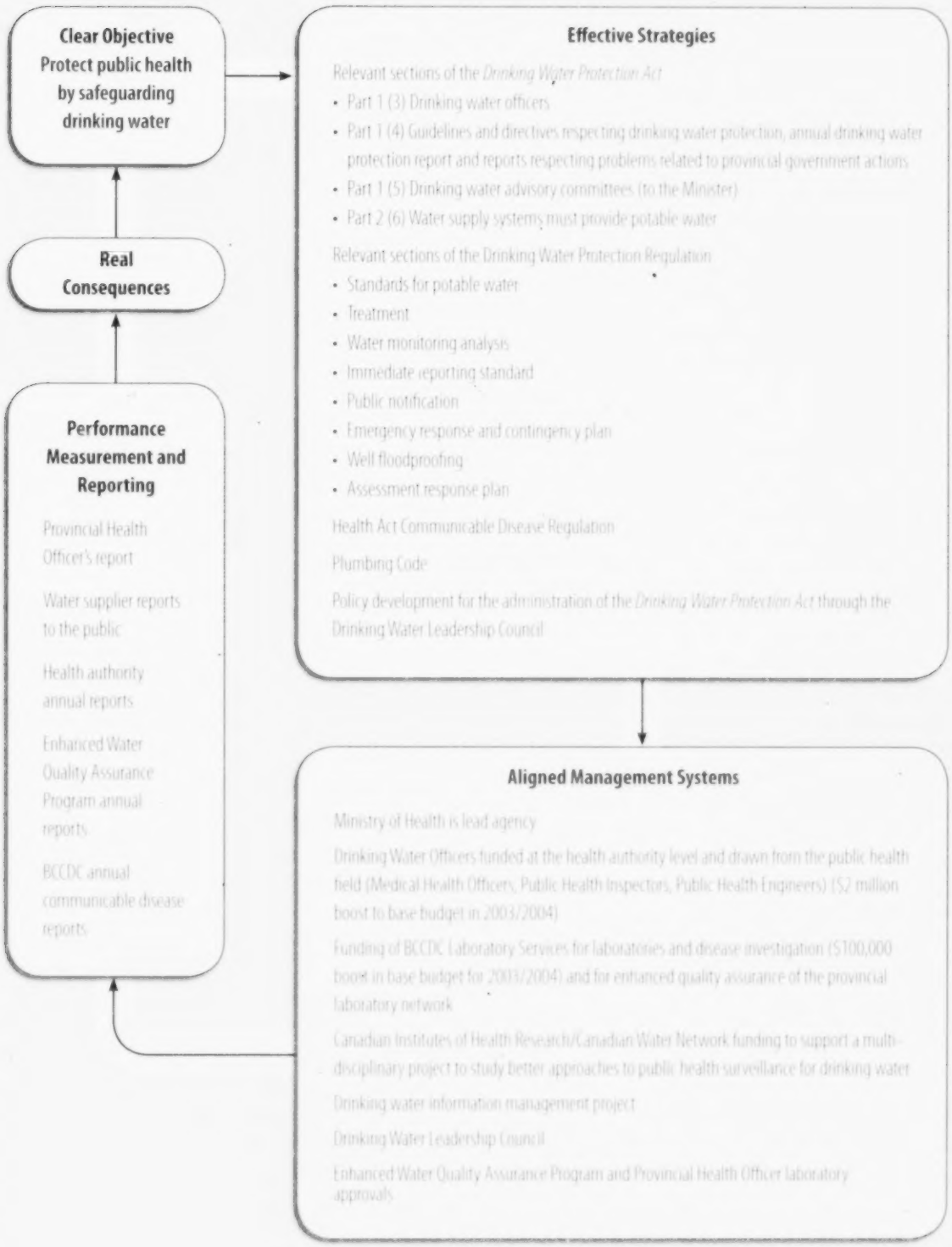

Clear Objective
Protect public health by safeguarding drinking water
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Water supplier reports to the public
Health authority annual reports
Enhanced Water Quality Assurance Program annual reports
BCCDC annual communicable disease reports
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 1 (3) Drinking water officers
• Part 1 (4) Guidelines and directives respecting drinking water protection, annual drinking water protection report and reports respecting problems related to provincial government actions
• Part 1 (5) Drinking water advisory committees (to the Minister)
• Part 2 (6) Water supply systems must provide potable water
Relevant sections of the Drinking Water Protection Regulation
• Standards for potable water
• Treatment
• Water monitoring analysis
• Immediate reporting standard
• Public notification
• Emergency response and contingency plan
• Well floodproofing
• Assessment response plan
Health Act Communicable Disease Regulation
Plumbing Code
Policy development for the administration of the Drinking Water Protection Act through the Drinking Water Leadership Council
Aligned Management Systems
Ministry of Health is lead agency
Drinking Water Officers funded at the health authority level and drawn from the public health field (Medical Health Officers, Public Health Inspectors, Public Health Engineers) ($2 million boost to base budget in 2003/2004)
Funding of BCCDC Laboratory Services for laboratories and disease investigation ($100,000 boost in base budget for 2003/2004) and for enhanced quality assurance of the provincial laboratory network
Canadian Institutes of Health Research/Canadian Water Network funding to support a multi-disciplinary project to study better approaches to public health surveillance for drinking water
Drinking water information management project
Drinking Water Leadership Council
Enhanced Water Quality Assurance Program and Provincial Health Officer laboratory approvals

Table 2: Key activities related to drinking water in BC 1999-2005

Date	Activity
1999	Release of BC Auditor General's Report – *Protecting Drinking Water Sources.*
April 2001	*Drinking Water Protection Act* passed (replacing existing legislation under the *Health Act* and the Safe Drinking Water Regulation).
September 2001	Establishment of the Drinking Water Review Panel, charged with the review of the *Drinking Water Protection Act* in order to recommend changes.
October 2001	Release of 2000 Provincial Health Officer's Annual Report, focused on drinking water.
February 2002	Drinking Water Review Panel report released.
June 2002	Action Plan for Safe Drinking Water in British Columbia published.
October 2002	Amendments made to *Drinking Water Protection Act*.
May 2003	Drinking Water Protection Regulation passed, and *Drinking Water Protection Act* brought into force, with additional regulations to be developed in the future.
May 2003 – March 2005	Implementation of the *Drinking Water Protection Act*: drinking water officer positions created and officers recruited, assessment screening tool developed, drinking water officer guidance manual initiated, review of small system needs started.

1.3 Progress and Accomplishments 2003/2004 and 2004/2005

Over the last several years, considerable progress has been made to enhance public health protection related to drinking water in British Columbia (see Table 2). In the 2003/2004 and 2004/2005 fiscal years, the provincial government, health authorities and water suppliers focused on implementing the requirements of the *Drinking Water Protection Act* and its regulation.

1.3.1 Effective Strategies

To address the objective of protecting public health by safeguarding drinking water supplies, a number of strategies were put in place. These include:

- Sections of the *Drinking Water Protection Act* and its regulation that reinforce the responsibility of water suppliers to supply the public with potable water that meets health-based standards and objectives were brought into force in May of 2003.
- To ensure that the focus of the legislation is a public health priority all medical health officers in the Province have been given the responsibility to administer the *Drinking Water Protection Act* as drinking water officers.
- Each health authority established new positions to carry out the responsibilities of drinking water officers.
- An improved reporting system to provide feedback to the Ministry of Health and to its Minister from health authorities was established through the creation of the Drinking Water Leadership Council.

These new strategies complement or expand on strategies that have been in place for many years including previous drinking water legislation under the *Health Act*, the existence of staff within health authorities responsible for administering that legislation, provincial policies to support those staff, BCCDC laboratory services for water testing and provisions of the plumbing code requiring the use of safe materials in plumbing and prohibiting cross connections between drinking water supplies and sources of contamination.

Drinking Water Personnel

Following the requirements of Part 1, Section 3 of the *Drinking Water Protection Act*, a number of new positions with authority and responsibility over drinking water issues were created in the regional health authorities and at the provincial level in 2003/2004. Recruitment to fill these positions continued into 2004/2005.

- **Provincial Drinking Water Officer:** With the increased role of the Office of the Provincial Health Officer to provide advice, accountability and a public health focus on drinking water issues, a new position of Provincial Drinking Water Officer was created within the Office of the Provincial Health Officer to deal specifically with drinking water issues. This position was filled in March 2004.

- **Drinking water positions in health authorities:** Starting in 2003 health authorities received a $2 million increase to their base budgets to hire additional staff for administration of the *Drinking Water Protection Act*. Funding was allocated to health authorities based on the number of water supplies in each health region. During 2003/2004 a total of 20 new positions were created and have subsequently been staffed by certified public health inspectors and professional engineers and geoscientists. Existing medical health officers, appointed under the *Health Act*, are named as drinking water officers in the *Drinking Water Protection Act* and, in turn, have delegated their authority, or appointed other staff within a health authority as drinking water officers under the Act.

Guidelines, Directives and Reports

The *Drinking Water Protection Act* gives the Minister of Health the power to establish guidelines and directives that must be considered or followed by drinking water officers and other officials who are responsible for carrying out duties under the Act.

In the fall of 2003, the Minister used this power to direct all the health authorities to develop protocols to ensure orders to issue public notification are followed. The directive was issued in response to a situation in August 2003 when a utility owner was ordered to notify his customers to boil their water. The drinking water officer ordered the boil water advisory because of a number of concerns, including the presence of fecal coliform bacteria in water samples. The officer followed up by phoning the owner and leaving voice messages on several occasions. The calls were not returned. Three weeks after the original order was issued, the inspector returned to the community where he learned that the advisory had not been issued. The directive was issued by the Minister to prevent such inaction by water suppliers in the future.

Part 1, Section 4, of the Act requires the Provincial Health Officer to prepare and deliver an annual report on activities under the *Drinking Water Protection Act*. This report for 2003/2004 and 2004/2005 fulfills this requirement. Additional reports will be made in subsequent years.

Drinking Water Advisory Committees (to the Minister)

Part 1, Section 5, of the Act gives the Minister of Health an opportunity to establish an advisory committee to provide advice and recommendations on drinking water issues. To date no special drinking water advisory committees have been struck by the Minister.

1.3.2 Aligned Management Systems

The provincial government is aligning its management systems to protect public health. As mentioned, while the Ministry of Health has been responsible for administering drinking water regulations for many years, the Ministry of Health is now designated as the lead agency responsible for drinking water quality. Given the number of government ministries and agencies that deal with water issues, having one lead agency reduces confusion and duplication and facilitates coordination of activities across ministries.

The provincial government has also started a drinking water information management project to collect and report data on various aspects of drinking water quality and management in BC (see Section 3.3.2).

The Ministry of Health has committed $2 million per year to the regional health authorities to create and support the new drinking water officer positions (see Table 3). This funding was allocated to health authorities based on the number of water supply systems within their jurisdiction.

The Ministry of Health has also provided funding to BCCDC to improve laboratories and disease investigation ($100,000 increase). A Drinking Water Leadership Council was created

Table 3: Increase in annual base budget to health authorities for drinking water officer positions since 2003 and current drinking water staff level

Health Authority	Resources allocated ($)	Current number of staff
Vancouver Coastal	105,798	5
Fraser	317,927	11.83
Vancouver Island	308,381	5.25
Interior	891,587	32.00
Northern	376,306	5.68
Total	**2,000,000**	**59.76**

to guide the development of policies required to administer the *Drinking Water Protection Act* and to coordinate other activities that support drinking water officers and government decision makers (for more information on the Drinking Water Leadership Council, see Section 3.3.2).

In 2003/2004 and 2004/2005, the regional health authorities hired 20 new staff and established their drinking water teams. Feedback from the health authorities indicates that approximately 60 full-time equivalent (FTE) positions have been allocated to their drinking water programs. Some staff in a region may have partial responsibility for drinking water. In all cases, strong communication and teamwork among the individuals involved in making decisions about drinking water issues is paramount.

In the Interior Health Authority, for example, the following positions have full or part-time responsibility for drinking water:

1 Drinking water manager

4 Senior drinking water officers

4 Public health engineers

4 Medical health officers

50 Public health inspectors

In the Fraser Health Authority, three medical health officers have partial responsibility as drinking water officers and have delegated authority to the following people:

1 Manager of the drinking water program

1 Drinking water coordinator (0.6 FTE)

6 Public health inspectors

1 Public health engineer

For a summary of positions in each of the regional health authorities, see Appendix A.

It should be noted that 2004/2005 was a year of transition for the province's drinking water program. New positions created after the initial $2 million was allocated to the health authorities were largely staffed by, or during, the 2004/2005 fiscal year. With staff increases, regional programs were restructured. This restructuring also involved the amalgamation of the drinking water programs of multiple small health regions into the five larger regional health authorities. The transitional process undertaken by each health authority in 2004/2005 is detailed throughout this report.

1.3.3 Performance Measurement and Reporting

The performance of the provincial government, the health authorities and water suppliers in protecting public health from drinking water contamination is assessed in a number of ways. Foremost is the incidence of illnesses that can be traced back to drinking water supplies. Other indicators of water quality, such as the results from water sampling and monitoring programs, are also reported and can be analysed to make sure public health is being adequately protected.

In addition to reporting by the Provincial Health Officer, the BCCDC also releases annual reports on its activities and on rates of reportable disease in the province. The health authorities and the BCCDC report on performance measures such as outbreaks of waterborne disease, enteric disease counts and laboratory testing results for microbiological and chemical parameters in water. The fundamental performance goal for the potability of water is the absence of waterborne disease. Over the last few years, substantial progress has been made to reduce risks in this area.

Waterborne Disease

Waterborne disease may occur as outbreaks—affecting numbers of people—or individual sporadic cases.

In the two decades prior to 1999, the province was affected by outbreaks of cryptosporidiosis, giardiasis, salmonellosis, campylobacteriosis and toxoplasmosis. Outbreaks affecting a relatively small number of people may have occurred but not been identified or reported. Since January 1999 to March 31, 2005, only one outbreak of waterborne communicable disease has been confirmed in BC.

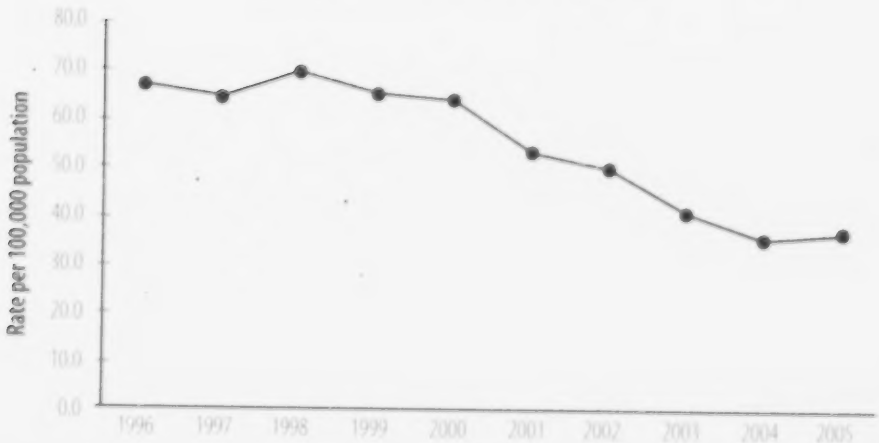
Five laboratory-confirmed cases of campylobacteriosis were identified in the community of Hagensborg in the summer of 2004. Follow-up investigation indicated that many more people in the community were affected. The investigation undertaken by the medical health officer and the drinking water officer concluded that the water supply was the source of the outbreak. Prior to the outbreak, a boil water advisory had been put on the system due to inadequate water treatment and failure to meet the microbiological schedule of the Drinking Water Protection Regulation. Because there is little human activity in the watershed, wildlife is believed to have been the source of contamination. Improvements to treatment used by this system are still required.

Even though the outbreak in Hagensborg is the only one definitely linked to water in 2004, more than 5,200 cases of enteric communicable diseases were reported in BC that year. A number of studies have found associations between sporadic cases of cryptosporidiosis and giardiasis and the consumption of inadequately treated tap water. Gastrointestinal illness can be spread by food, water or person-to-person contact, making it difficult to determine the source of enteric infection. In general, there has been a downward trend in reported cases of most enteric pathogens over the past decade. The number of cases of cryptosporidiosis has remained fairly stable, but that of giardiasis has declined each year—from a high of 1,651 confirmed cases in the 1992 calendar year to 740 in 2004.

Figures 6 to 10 are adapted from the BCCDC's *Annual Summary of Reportable Diseases (2004)*. They show the rates of the following enteric communicable diseases between 1995 and 2004: campylobacteriosis, cryptosporidiosis, giardiasis, verotoxigenic E. coli infection and salmonellosis.

Figure 6

Campylobacteriosis Rates by Year, 1996 - 2005

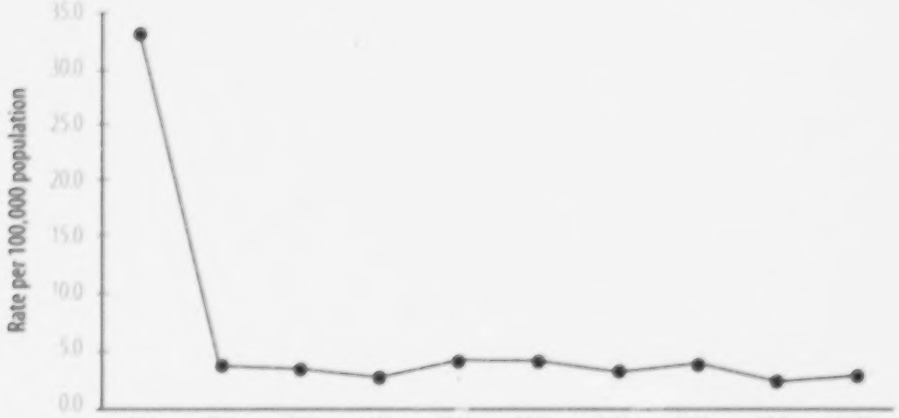


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BC Campylobacteriosis Reports	2587	2549	2760	2613	2583	2192	2052	1712	1472	1568
BC Campylobacteriosis Rate	66.8	64.6	69.3	65.1	63.9	53.7	49.9	41.2	35.1	37.0

Figure 7

Cryptosporidiosis Rates by Year, 1996 – 2005

Waterborne outbreaks of cryptosporidiosis occurred in Cranbrook and Kelowna in 1996, resulting in the high number of cases that year.

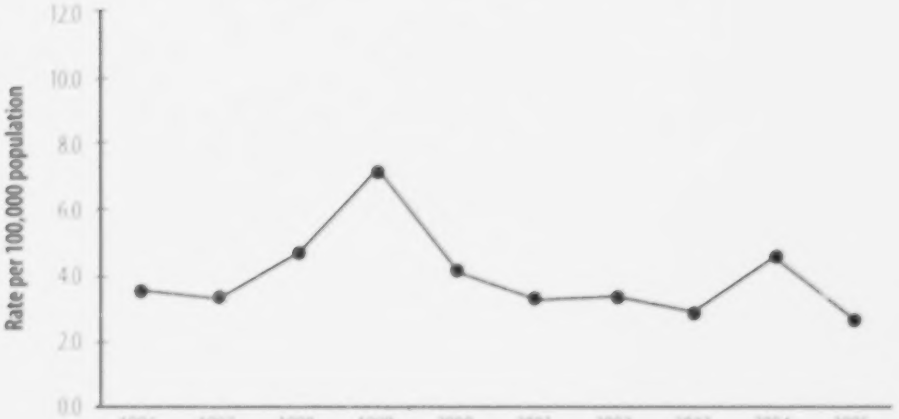


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BC Cryptosporidiosis Reports	1278	144	139	109	167	173	130	162	100	124
BC Cryptosporidiosis Rate	33.0	3.6	3.5	2.7	4.1	4.2	3.2	3.9	2.4	2.9

Figure 8

Verotoxigenic *E.coli* Infection Rates by Year, 1996 – 2005

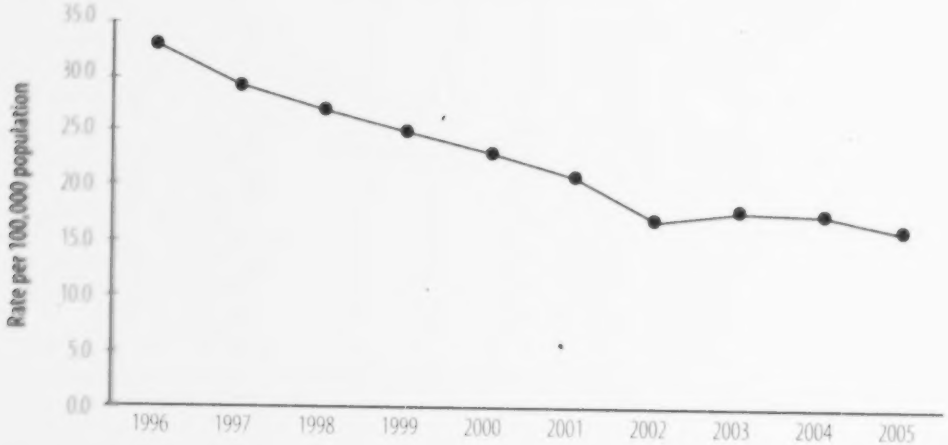
In 1999 four food-related outbreaks of verotoxigenic *E. coli* occurred. Additional cases were linked to contaminated ground beef, petting zoos and a childrens' water park.



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BC Verotoxigenic E.coli Reports	137	132	185	287	166	136	140	123	193	115
BC Verotoxigenic E.coli Rate	3.5	3.3	4.6	7.2	4.1	3.3	3.4	3.0	4.6	2.7

Figure 9

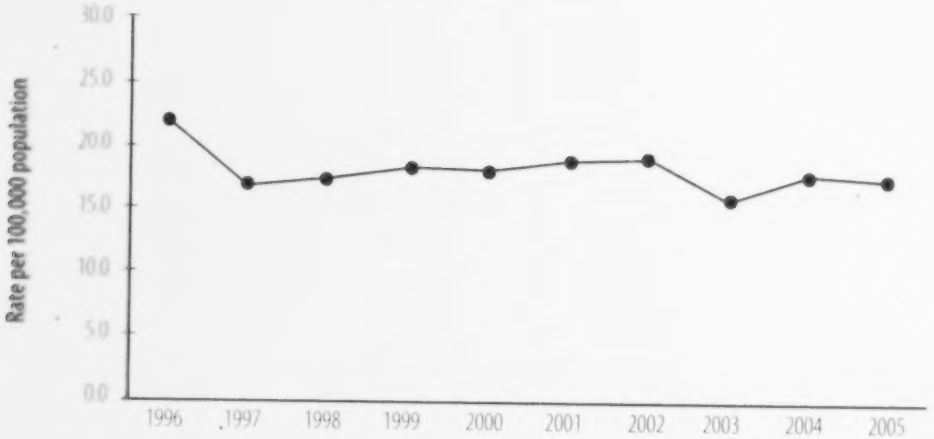
Giardiasis Rates by Year, 1996 – 2005



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BC Giardiasis Reports	1274	1158	1075	1009	941	860	710	742	739	687
BC Giardiasis Rate	32.9	29.3	27.0	25.2	23.3	21.1	17.3	17.9	17.6	16.2

Figure 10

Salmonellosis Rates by Year, 1996 – 2005



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BC Salmonellosis Reports	852	667	679	725	727	763	790	660	749	739
BC Salmonellosis Rate	22.0	16.9	17.0	18.1	18.0	18.7	19.2	15.9	17.8	17.4

Table 4: Cases of enteric diseases reported in BC, 2003 to 2005

Enteric disease	2003	2004	2005
Campylobacteriosis	1,712	1,472	1568
Giardiasis	742	739	687
Cryptosporidiosis	162	100	124
Verotoxigenic *E. coli* infections	123	193	115
Salmonellosis	660	749	739
Total	3,399	3,253	3,233

Source: 2005 British Columbia Annual Summary of Reportable Diseases, British Columbia Centre for Disease Control, 2005.

Table 4 shows the number of cases of these enteric diseases reported in BC in 2003, 2004 and 2005.

Fecal Coliform Tests

In 2003, the BCCDC Laboratory Services conducted 57,887 tests for fecal coliforms in drinking water, of which 1.7 per cent (1,010 samples) were positive. This percentage had been declining over the previous four years. For instance, in 2000, out of 41,505 tests, 2.5 per cent (1,041) were positive. This decline represents a small but positive trend that could indicate an improvement in overall water quality. However, it could simply reflect an overall increase in the total number of samples being collected from the public water supply systems with higher quality water. Improved data collection and reporting through the drinking water information management project will help answer such questions in the future (see Section 3.3.2).

Boil Water Advisories

As noted in Section 1.1.2, 393 boil water advisories were in effect in the province in November 2003 (see Table 5). The majority of these were placed as a precaution on smaller systems that inadequately treat surface water. For instance, the residents of Erickson, BC, had been on a boil water advisory for nearly a decade because the water supply was untreated, contained fecal bacteria and had been responsible for two community-wide disease outbreaks in the past. Now the community is building a $10 million ultrafiltration treatment system which will resolve concerns about the water being inadequately treated. For more information about drinking water infrastructure upgrades in communities around the province, see Section 5.3.2 and Appendix C.

While most boil water advisories are in place for small systems during periods of operational upset, such as when a treatment plant experiences a failure, or because of extenuating environmental circumstances, larger communities may also be placed on short-term notice to boil or otherwise treat their drinking water. Some of the larger water suppliers that issued advisories in 2003/2004 included the municipalities of Kamloops and Kimberly. The advisory in Kamloops was

Table 5: Number of boil water advisories, by health authority (November 2003)

Health Authority	Number of Boil Water Advisories	Percentage of Public Water Supply Systems Affected
Vancouver Coastal	62	26.0 %
Vancouver Island	41	4.9 %
Fraser	54	11.0 %
Interior	189	13.5 %
Northern	47	4.7 %
Total	**393**	**10.0 %**

issued because of high levels of turbidity in source waters. In Kimberly, the advisory was issued when fecal coliforms were detected in the distribution system. In both cases, the public was notified and action was taken.

As the largest water supplier in the province, the Greater Vancouver Regional District maintains a routine program for notifying its customers when source waters from any of its three reservoirs experience increased turbidity. This program is expected to continue until improved treatment, including filtration, is in place in 2008.

The challenge for the regional health authorities, regional districts, municipalities and water suppliers in future years will be to correct the deficiencies that necessitate boil water advisories, rather than focus on snapshot counts. In most cases, the corrective action needed is for surface water supplies to be disinfected. In many cases, more advanced treatment with filtration is needed. More detail on the number of public water supply systems in BC that will soon be providing improved water quality to British Columbians, and in some cases removing long-standing boil water advisories, is provided in Appendix C. Between 2003 and 2005, 42 infrastructure improvement projects received a total of approximately $60 million under the Canada-BC Infrastructure Grant Program.

Additional Performance Measurement and Reporting

The Enhanced Water Quality Assurance (EWQA) Program is a public health quality assurance program reporting to the Provincial Health Officer. The EWQA Program provides expert recommendations for laboratory approval, provides education and training of auditors and publishes a newsletter. It also prepares annual reports on its activities related to approving the laboratories that analyse drinking water samples in BC. The current list of approved laboratories is maintained online (http://www.pathology.ubc.ca/education/certificate_programs/Enhanced_Water_Quality_Assurance/PHO_-_Approved_Laboratory_List.htm). The provincial government's investment in the drinking water information management project will make it possible to track meaningful data and to compare it across the province. Future reporting will be enhanced through the development of this project.

The Office of the Provincial Health Officer will continue to prepare public reports such as this one on activities that have taken place under the authority of the DWPA. The reports will be reviewed by the Legislative Assembly and other government decision makers to determine where and how the government's objectives, strategies and management systems need to be changed in order to continue to ensure public health is protected.

In addition, under Section 15 of the Act, public water suppliers must report the following to the public in accordance with the regulations and any requirements specified by the drinking water officer. These requirements may be attached to operating permits.

- Emergency response and contingency plans.
- Monitoring results.
- Assessment results and assessment response plans (if applicable).

1.3.4 Gaps

The provincial government, health authorities and water suppliers face a number of challenges in their ability to meet the objective of protecting public health while safeguarding drinking water. These gaps include:

- The absence of a province-wide, real-time tracking system for water quality data that provides the reason for a boil water advisory or details on the population affected. A snapshot count of the number of advisories in place at a given time fails to provide meaningful information. How many are in place because of inadequate disinfection or inadequate treatment? How many arise because tests have revealed the presence of coliform bacteria during water monitoring? How many are long-term and how many reflect temporary situations that are rapidly resolved? How many people might be affected? Given that boil water advisories can be applied for a number of reasons, accurate information is essential to make progress on this issue. These information gaps are intended to be addressed through the drinking water information management project.

- Explicit performance measures related to each section of the DWPA. These are needed to ensure that overall accountability reporting under the Act can be undertaken. These measures are being developed through the drinking water information management project.
- Policies in support of the DWPA, such as a completed, comprehensive policy and technical guidance manual for drinking water officers.[11]

[11] *The* Drinking Water Officers' Guide *was completed in January 2006 and is available online at http://www.health.gov.bc.ca/protect/dwoguide.pdf*

2. Source Water Protection

2.1 Context

2.1.1 Source Protection

Water of virtually any quality can be treated to provide safe drinking water, but the cost of treatment and the risks to health from treatment failures increase as source water quality deteriorates. The risks naturally associated with source water can be made worse by contamination that adds hazardous substances to the source water, adds substances that can interfere with treatment processes or adds to the conditions that promote the creation of disinfection by-products.

The Auditor General's 1999 report, *Protecting Drinking Water Sources*, discussed the impacts of logging, cattle grazing, mining, outdoor recreation, transportation, agriculture and human settlement on source water quality. The importance of source water protection was dramatically illustrated by the Cranbrook outbreak of cryptosporidiosis that resulted from the contamination of source water by cattle manure containing the parasite.

From the public health perspective, source water protection is a necessary, but not sufficient, component of a multi-barrier approach. Good source protection can prevent some contaminants from entering the water supply, but even the most pristine watershed devoid of human activity can still harbour contaminants harmful to human health. Banning all human activity in a watershed does not guarantee the water will be safe to drink.

For example, the Greater Vancouver Water District and the Capital Regional District own or have control over most of their watersheds and can prevent or limit human activities in those areas. These restrictions have not, however, prevented all waterborne disease outbreaks. In 1995, Victoria was affected by an outbreak of toxoplasmosis that was attributed to feral cats or cougars in the watershed (Provincial Health Officer, 2001).

This example illustrates the limitations on the water quality improvements that may be achieved solely as a result of better protection or management of the land that recharges surface water sources. These limitations are based on the inevitable presence of pathogens such as *Cryptosporidium* and *Giardia* from animals and on the difficulty in maintaining low turbidity, particularly during times of high rainfall or during the spring snowmelt. In another example, concurrent

Sources of drinking water

Seventy-five per cent of drinking water in BC comes from surface water, which is highly vulnerable to being contaminated by humans or animals. Some 25 per cent of BC drinking water comes from groundwater — water that comes from wells which are fed by underground water sources called aquifers. While deep aquifers are generally less subject to contamination than surface water, the water may contain elements from bedrock like arsenic, fluoride (which is known to be beneficial at low levels) and uranium. Shallow aquifers or poorly constructed wells can be susceptible to contaminants from run-off such as agricultural fertilizers, nitrates and animal manures.

waterborne outbreaks of giardiasis and campylobacteriosis occurred in Revelstoke in 1995 despite the community having a restricted-access watershed. A beaver living near the water intake was clearly identified as a source of *Giardia* cysts. The source of the *Campylobacter* is unknown, but was likely related to other wildlife.

More important than banning all human activities in watersheds is to understand what risks the activities pose and what contaminants are likely to be introduced from those activities into the water. These risks can then often be reduced or eliminated by carefully managing land uses and adopting appropriate water treatment practices. These activities form the basis of watershed management.

Watershed management should be a transparent, multi-stakeholder process that balances the goals for water quality protection against other land use interests or needs, development or management of natural resources. That said, while multiple-use watersheds will remain common in British Columbia, the competing uses must not compromise the safety of drinking water delivered to the consumer. For these reasons, land use planning and source water protection planning are important tools for protecting drinking water sources.

Off-Stream Watering near Kamloops

Each year, from February to April, some 150 cows with their newborn calves feed at a site on the Wolf Ranch by the South Thompson River in the Interior of BC.

To discourage the cow-calf pairs from going into the river to drink — young calves often carry large amounts of *Cryptosporidium* — a watering station was placed about 150 metres up from the bank on a trail to the river. After the installation of the watering station, overall livestock use of the river decreased by an estimated 80 per cent.

Observations of cattle behaviour at the site show that cows will use the most readily available water. Tempting green grass on the riverbank or too long waits at the watering station, however, can lure cattle back to the watercourse. A temporary barrier on the trail or at the access points can provide enough discouragement and time for cows to change their behaviour and accept the watering station as their preferred drinking hole.

Source Protection Legislation

Part 4 of the DWPA deals with source water protection, including:

- Prohibiting drinking water sources from being contaminated with any substance that may result in a health hazard.
- Prohibiting any part of a water supply system from being tampered with in any way that might result in a health hazard.
- Requiring spills to be reported to drinking water officers.

It also gives drinking water officers the authority to order anyone who has caused or contributed to the contamination of a drinking water source to stop the offending activity, provide more information, conduct tests and analyses, notify the public of the hazard and/or remediate the situation.

Part 5 of the DWPA deals with drinking water protection plans. The Minister of Health can order these plans to be developed if it is determined that this would be the only way to deal with a health hazard associated with the drinking water supply. Either a water supplier or a local authority can ask the Provincial Health Officer to recommend that the Minister order the development of a drinking water protection plan. No requests to initiate a drinking water protection plan were received in either 2003/2004 or 2004/2005.

All drinking water protection plans must include a public consultation component. Draft plans must be presented to the Minister of Health, reviewed by the Provincial Health Officer, and approved by the Lieutenant Governor in Council, who has the authority to issue consequences if the plan is not followed.

Similar planning provisions exist in the *Water Act* to include groundwater protection and water management plans in critical areas.

Source Protection Programs

Various government ministries collaborate with external organisations and individuals to deliver programs to reduce the range and quantity of pollutants entering water sources. These programs aim to keep livestock out of source water, help farmers develop environmental farm plans and conserve water supplies. These programs continue to build on existing practices.

- **Off-Stream Watering:** Livestock, particularly cattle, standing beside or directly in streams and rivers to drink can introduce pathogens like *Cryptosporidium*, *E. coli* and *Giardia* into a community water source and degrade water quality. By situating a watering station away from the watercourse at a convenient location, cattle can be encouraged to drink from water inland, protecting the water supply. In association with the Kamloops Stock Association, four test sites in recent years have been established in the Interior. They are showing that off-stream watering can significantly reduce livestock use of unfenced watercourses. But these programs come at a price that currently must be absorbed by the livestock owner. According to the Ministry of Environment, each installation costs about $5,000. These costs can be partially funded under the National Farm Stewardship Program. While the benefits to livestock, the environment and water quality need to be further documented for off-stream watering to become standard practice, discussion is needed on sharing the cost between landowners and others, such as consumers of a community water supply who benefit from such arrangements. Policy and legislative amendments may also be required to permit ranchers to divert water from streams in cases where these have already been designated as "fully allocated" by the Ministry of Environment or Fisheries and Oceans Canada.
- **Environmental Farm Plan (EFP) Program:** Fertilizers, herbicides, pesticides and parasites and bacteria from livestock manure can run off farmland and enter surface water or seep into groundwater. The EFP Program is a voluntary, confidential federal-provincial program delivered in BC by the BC Agriculture Council. It was launched in BC in 2003. Producers who choose to participate in the program attend an EFP workshop in their area, perform an environmental risk assessment of their farm operation, develop a plan to mitigate any identified risks and submit the plan for a confidential review by certified planners. Farmers with approved plans are eligible to apply for financial incentives to undertake projects that will enhance the environmental performance of their farm. Funded by the federal and provincial governments, the program helps farmers apply sound environmental practices, which in turn will protect water sources, among other benefits. This program has proven to be an effective approach to encouraging farmers to protect water sources. For more information, see http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning or http://www.bcac.bc.ca/efp_programs.htm.
- **Observation Wells:** The Observation Well Network was developed in the early 1960s. The wells are used to monitor groundwater supplies in the province's major aquifers. More information on the Observation Well Network can be found online at http://www.env.gov.bc.ca/wsd/data_searches/obswell.

Land Use Management

The mainstay of source water protection is embedded in legislation that governs land use. Most human activities that may result in source water contamination are controlled by a combination of provincial and federal legislation and local by-laws. The laws that cover resource extraction, industry, agriculture and residential development all include components designed to prevent impacts on water quality. Legislation governing forestry activity also includes elements intended to prevent changes in available water quantity and timing of flow (i.e., restrictions on how much of a watershed can be logged over a period of time are intended to ensure that snow melt does not occur too early in the year, resulting in early freshet and longer periods of low flow during the summer and fall).

During 2003/2004 and 2004/2005, numerous pieces of provincial legislation and policies governing land use were amended or replaced. The *Forest Practices Code of British Columbia Act* was replaced by the *Forest and Range Practices Act*. Changes were made to legislation governing mineral exploration, agriculture and waste management. A guiding principle behind some of these changes was the recognition

that drinking water sources needed to be protected through enhanced provisions. The ministries responsible for these legislative changes all have representatives on both the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water.

2.1.2 Drought Preparedness and Water Conservation

BC is most often known for its periods of intense rain, but drought can also pose a significant problem and put stress and strain on water sources.

Most of the surface water sources in BC's Interior are replenished from precipitation and snow in winter months and then depleted in dry summers. Coastal water supplies often rely on year-round rain or on reservoirs that are replenished during fall, winter and spring rains. Groundwater aquifers also rely on precipitation to "recharge" after periods of drought or heavy use.

Certain areas of BC have been experiencing ongoing drought.[14] Some of the province's aquifers, streams and lakes have been at their lowest levels in more than 50 years. Snow packs were smaller than usual during the 2003/2004 winter. By the end of 2004/2005 (April 1st report), snow conditions were quite variable across the province, with much of southern BC having below normal snowpacks and central and northern BC having near normal or above normal snowpacks. For Vancouver Island and the Similkameen Valley, the April 1, 2005, snow water conditions were at a record low. For more information, see http://www.env.gov.bc.ca/rfc/archive/2005/index.html.

Low flow, due to drought or normal seasonal fluctuations, can result in threats to health. It can lead to degraded water quality, loss of the source water or reduced availability of water for community use—including the loss of firefighting capability.

In many BC communities, drought has exacerbated water shortage problems resulting from naturally low water availability in summer months and from increasing water demands from agricultural, industrial and community development. Even without drought, many regions need to improve water demand management to ensure the limited amounts of water available can meet all community needs, both now and in the future. It is common for many BC communities, particularly during dry summer months, to enact water restrictions to curb water use and conserve supplies. If climate change shifts BC's patterns of precipitation, more effort may be necessary to safeguard the quantity of the province's water supplies.

The need to prepare for drought conditions should not overshadow the danger of simply using water faster than the rate at which it is replenished during the best of times. Some water sources have been seriously affected by long-term overuse. Data from select observation wells show that several aquifers are experiencing long-term drops in water levels resulting more from overuse than drought.[15]

Water conservation is an important component of source protection and drinking water management.

Emergency Restrictions in Summerland

After an extremely hot and dry summer in 2003, the town of Summerland in the Okanagan was faced with potentially running out of drinking water by the end of August. The district declared a state of emergency and put in place Stage Four water restrictions, which banned all sprinkler use, car washes or extraneous use of water. Water flow to the Trout River, a fish-bearing stream, was also cut off, killing the fish.

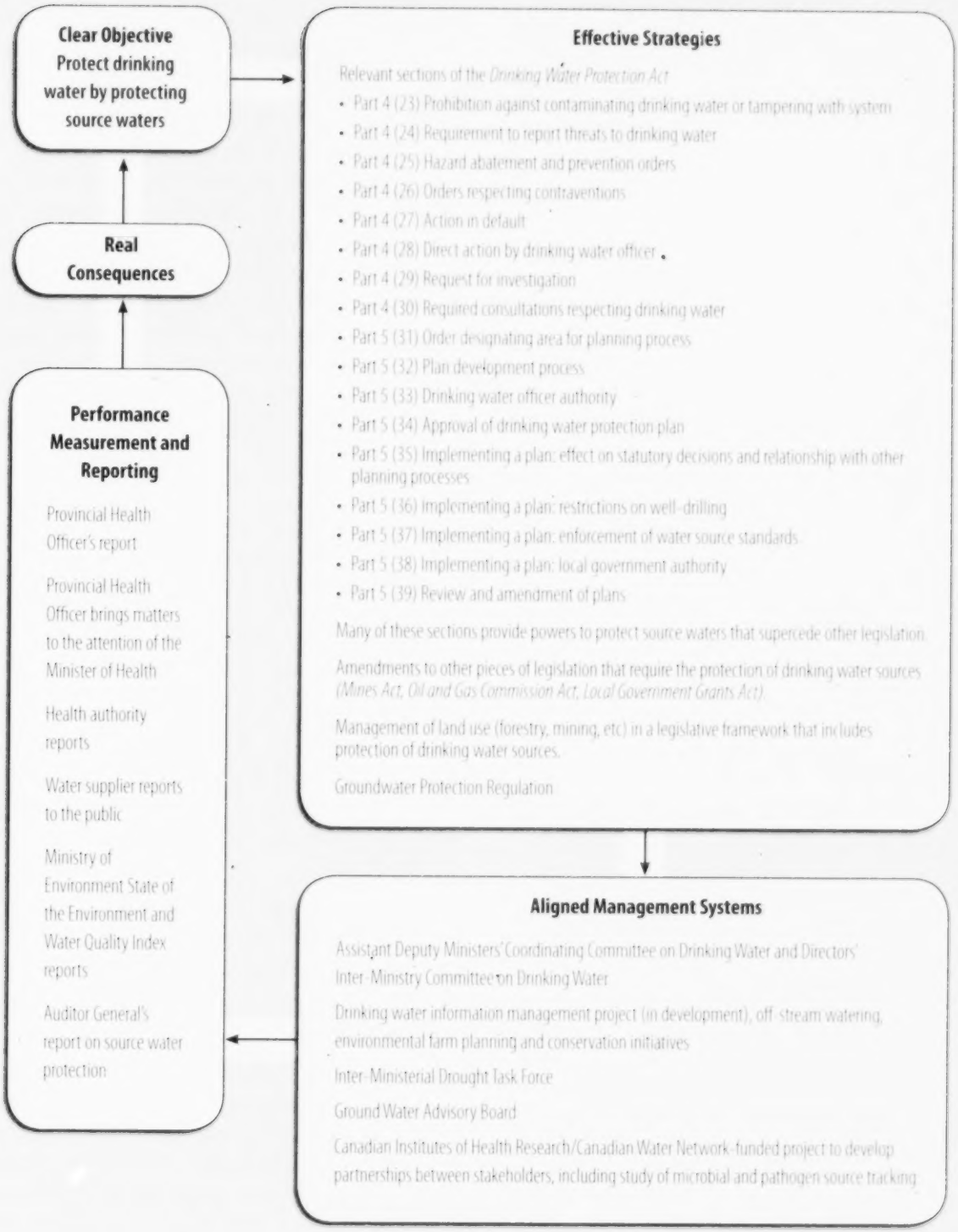
The conservation effort was able to reduce water use by 50 per cent, stretching the town's water supply to last until a new groundwater source could be found and tapped.

[14] For more information, see http://www.env.gov.bc.ca/wsd/public_safety/drought_info/index.html

[15] For examples of conditions seen at observation wells 5, 125, 154, 232, see http://www.env.gov.bc.ca/wsd/data_searches/obswell/welllindex.html

Figure 11

Principle 2: Source protection is a critical part of drinking water protection


Clear Objective
Protect drinking water by protecting source waters
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Provincial Health Officer brings matters to the attention of the Minister of Health
Health authority reports
Water supplier reports to the public
Ministry of Environment State of the Environment and Water Quality Index reports
Auditor General's report on source water protection
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 4 (23) Prohibition against contaminating drinking water or tampering with system
• Part 4 (24) Requirement to report threats to drinking water
• Part 4 (25) Hazard abatement and prevention orders
• Part 4 (26) Orders respecting contraventions
• Part 4 (27) Action in default
• Part 4 (28) Direct action by drinking water officer
• Part 4 (29) Request for investigation
• Part 4 (30) Required consultations respecting drinking water
• Part 5 (31) Order designating area for planning process
• Part 5 (32) Plan development process
• Part 5 (33) Drinking water officer authority
• Part 5 (34) Approval of drinking water protection plan
• Part 5 (35) Implementing a plan: effect on statutory decisions and relationship with other planning processes
• Part 5 (36) Implementing a plan: restrictions on well-drilling
• Part 5 (37) Implementing a plan: enforcement of water source standards
• Part 5 (38) Implementing a plan: local government authority
• Part 5 (39) Review and amendment of plans
Many of these sections provide powers to protect source waters that supercede other legislation.
Amendments to other pieces of legislation that require the protection of drinking water sources (Mines Act, Oil and Gas Commission Act, Local Government Grants Act).
Management of land use (forestry, mining, etc) in a legislative framework that includes protection of drinking water sources.
Groundwater Protection Regulation
Aligned Management Systems
Assistant Deputy Ministers' Coordinating Committee on Drinking Water and Directors' Inter-Ministry Committee on Drinking Water
Drinking water information management project (in development), off-stream watering, environmental farm planning and conservation initiatives
Inter-Ministerial Drought Task Force
Ground Water Advisory Board
Canadian Institutes of Health Research/Canadian Water Network-funded project to develop partnerships between stakeholders, including study of microbial and pathogen source tracking

2.2 Accountability

While there is no single source water protection program in British Columbia, many individual programs and land use management strategies incorporate the protection of drinking water sources as a fundamental value. In addition, the Ministry of Environment has a leadership and stewardship roles at the provincial level for source water protection. Five other resource-based ministries—forestry, mining, agriculture, transportation and sustainable resources[1]—engage in land use management and therefore in source water protection activities. The five regional health authorities regulate on-site sewage disposal. Local governments and the Ministries of Transportation and Community Services establish zoning by-laws and approve subdivisions. Drinking water officers are empowered under the DWPA to take actions related to the protection of source waters.

Figure 11 shows how the accountability framework discussed in the introduction applies to principle 2 of the Action Plan for Safe Drinking Water in British Columbia: "source protection is a critical part of drinking water protection." Progress and accomplishments related to each component are discussed in Section 2.3.

2.3 Progress and Accomplishments 2003/2004 and 2004/2005

A number of government activities focus on ensuring contaminants do not enter drinking water sources. The Ministry of Environment plays a lead role in source water protection activities that go beyond the requirements of the DWPA. Source protection activities include both legislation and programs.

2.3.1 Effective Strategies

A number of strategies are in place to ensure sources of drinking water are protected and that people or organizations whose activities may impact source water quality are held accountable. These strategies include:

- Sections of the *Drinking Water Protection Act* prohibit the contamination of water sources, require threats to water quality to be reported; give drinking water officers the authority to order hazards to be removed from a watershed or abated; and give the Lieutenant Governor in Council the power to order watershed or aquifer management plans to be developed and implemented.
- Many statutes contain provisions that place a mandate on government decision makers and resource users to consider the effects that resource use could have on water quality and to take steps to prevent adverse effects. These statutes include the *Environmental Assessment Act*, the *Farm Practices Protection (Right to Farm) Act*, the *Fish Protection Act*, the *Forest Practices Code of British Columbia Act*, *the Forest and Range Practices Act*, the *Health Act*, the *Hydro and Power Authority Act*, the *Local Government Act*, the *Oil and Gas Commission Act*, and the *Water Act*.
- Land use management strategies that include the protection of drinking water sources.
- Land use planning through a variety of legislative and non-legislative mechanisms that identify threats to drinking water sources and incorporate measures to protect sources from adverse impacts.

In 2003/2004, based on advice from a groundwater advisory board, industry and stakeholders, a groundwater protection regulation under the *Water Act* was under development that included standards for well construction, maintenance and closure, well identification and qualifications for drillers and well pump installers.

A range of legislation considers the protection of drinking water sources amongst other resource values. Two key pieces are the *Environmental Management Act*, passed in October 2003, and the *Forest and Range Practices Act*, brought into force in January 2004.

Numerous provisions under the *Petroleum and Natural Gas Act* are intended to protect drinking water. In wells drilled for oil and gas development, steel casing must be set below

[1] *The functions of the former Ministry of Sustainable Resource Management have since been transferred to the current Ministry of Environment, the Ministry of Agriculture and Lands and the Ministry of Forests and Range.*

the base of strata known or expected to serve as a source of drinking water. The Oil and Gas Commission has the power to suspend use of a water well as a source of water for oil and gas exploration, when it injuriously affects use of the water source for domestic or other purpose. There are a host of requirements to prevent pollution and, if spillage occurs, to remedy its cause or source, and restore and reclaim land or a watercourse affected by spillage.

In 2004/2005, Phase 1 of the Ground Water Protection Regulation started to come into force, requiring qualified well drillers and well pump installers to be registered with the province. The registries of qualified well drillers and well pump installers can be found at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells.html#reg.

In addition, between 2003 and 2005, amendments were made to a number of pieces of provincial legislation to protect drinking water sources. These include amendments to the *Mines Act*, the *Oil and Gas Commission Act*, and the *Local Government Grants Act*.

2.3.2 Aligned Management Systems

The provincial government, health authorities and water suppliers are aligning their management systems to protect public health. The Ministry of Health maintains linkages with the six other ministries that have varying levels of responsibilities for water: Environment; Agriculture and Lands; Forests and Range; Transportation; Energy, Mines and Petroleum Resources; and Community Services. For more information on these ministries and their water-related activities and responsibilities, see Appendix D. The linkages are maintained through the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water (see Section 3.3.2 for details).

At a regional level, decision-makers responsible for land use management consult with drinking water officers as needed. This consultation is often ad hoc and varies from region to region. In 2004/2005, a process to formalize consultation between ministry officials with a role in land use management and drinking water officers was initiated by the Directors' Inter-Ministry Committee on Drinking Water.

The Ministry of Environment has undertaken a range of activities to support source water protection, including hiring 12 groundwater and source water protection staff and establishing partnerships between regional ministry staff and the regional health authorities. For detailed information, see Appendix D.

Various government ministries collaborate with external organizations and individuals to deliver programs to reduce the range and quantity of pollutants entering water sources.

To support the Environmental Farm Plan Program, the Ministry of Agriculture and Lands spent $2.06 million in 2003/2004 to develop a policy framework, create planner guides, train planners and coordinate the program. It also has developed a number of fact sheets and other publications for livestock farmers about how to protect streams and other water sources from grazing cattle. For more information, see http://www.agf.gov.bc.ca/range/factsheets.htm#riparian.

The beef industry has also been involved with a "Cows and Fish" program for many years. This program, which is well-established in Alberta, helps cattle ranchers to manage their herds in ways that minimize impacts on water bodies. More information about this program is available at http://www.cowsandfish.org.

The Ministry of Environment has developed a Water $ave Tool Kit with the British Columbia Water & Waste Association to help encourage wise and conservative water use by consumers. Canadians use an average of 326 litres of water per person each day—almost double that of Europeans.

As part of the Observation Well Network, seven new observation wells were constructed and added in 2004/2005. Three of the wells were completed in the East Kootenays and four wells were completed on the east coast of Vancouver Island. The observation wells will monitor regional groundwater levels in those areas. More information about the Network can be found online at http://www.env.gov.bc.ca/wsd/data_searches/obswell.

In 2004/2005, the Ministry of Environment identified, mapped and classified 50 aquifers that are used as sources of drinking and/or irrigation water. The aquifer classification mapping was initiated in the Greater Victoria, Houston-Smithers-Terrace

and Peace River areas. The mapped aquifers are displayed in the BC Water Resources Atlas at http://srmapps.gov.bc.ca/apps/wrbc. The Ministry of Environment also initiated a partnership with Natural Resources Canada and Simon Fraser University to begin assessing and characterizing groundwater resources in the Okanagan Basin.

In addition to these programs, government launched two inter-ministerial programs in 2003/2004: an Inter-Ministerial Drought Task Force and the drinking water information management project. The Drought Task Force was created to coordinate drought response and related management activities, including the creation of a drought action plan. The action plan can be found online at http://www.env.gov.bc.ca/wsd/public_safety/drought_info/cabinet/action_plan.pdf.

Comprised of many of the same representatives on the Directors' Inter-Ministry Committee on Drinking Water (see Section 3.3.2), the Task Force is monitoring the condition of snowpacks, surface and groundwater supplies and creating coordinated actions to respond to droughts.

The drinking water information management project will help determine what information the various agencies involved in drinking water protection require to fulfill their drinking water responsibilities. In the case of source protection, the project will ensure that resource ministries are able to identify which bodies of water act as sources for drinking water and where drinking water infrastructure may be located within watersheds. This information will help make drinking water protection an integral component of land use decision making. See Section 3.3.2 for more information on the project.

Finally, the Ministry of Environment established a Ground Water Advisory Board in September 2003 to provide the ministry with recommendations on the development of groundwater regulations. This board remains active.

2.3.3 Performance Measurement and Reporting

The performance of the provincial government, health authorities and water suppliers in protecting water sources is measured and publicly reported through reports such as this one. As part of this exercise, the Provincial Health Officer will report on the successes and challenges facing the agencies tasked with managing land uses in ways that protect source waters. The Provincial Health Officer will also bring pressing matters to the attention of the Minister of Health.

The Office of the Auditor General also monitors the government's performance in protecting the province's drinking water sources. The 1999 Auditor General report, *Protecting Drinking Water Sources*, made a number of recommendations on how the province could strengthen its efforts to protect source waters.

The Ministry of Environment also publishes a number of reports including:

- Assessments of water quality at sampling stations around the province (http://www.env.gov.bc.ca/wat/wq/canada_bc_agreements/index.html)
- Water and sediment quality monitoring reports (http://www.env.gov.bc.ca/wat/wq/wq_sediment.html)
- State of the Environment reports (http://www.env.gov.bc.ca/soerpt)

As discussed earlier, the drinking water information management project is central to government's ability to measure and report on its performance. For instance, government has committed to an outcome-based approach in the provincial management of land uses that can affect drinking water sources. This approach is a substantial change from many of the compliance-based, prescriptive frameworks previously in place. To be effective, outcome-based legislation will require effective monitoring of the critical outcomes of each regulated activity. This type of comprehensive monitoring is only possible with the kind of technology being developed as part of the drinking water information management project.

The Forest Practices Board investigates and reports on forestry activities, including activities that are alleged to have adversely affected drinking water sources. The Board's reports are available online at http://www.fpb.gov.bc.ca.

2.3.4 Gaps

The provincial government, health authorities and water suppliers are challenged in their ability to meet the objective of protecting drinking water by protecting water sources, due to a number of gaps.

While considerable effort has been made to ensure that drinking water values are considered in land use management legislation, evaluating the impact of any one activity on a water source is often difficult. Moreover, there is seldom an obligation placed on the land users to maintain long-term programs to monitor their impact on water quality, quantity or timing of flow. If an activity does impact a source water (possibly years after the activity has ended), it is largely the responsibility of government or a water supplier to identify the impact.

Concern has been expressed by water suppliers and drinking water officers that the land users who benefit from their activity are not being held accountable to demonstrate that they are protecting water quality. In some cases, concern has been expressed that water quality deterioration is observed at water intakes and, while upstream activity is suspected as the cause, data is not available to determine the impact, if any, that one or more activities might be having on water quality (see Recommendation 4).

A problem with almost all land use activity is the limited understanding of how it can affect water quality from a human health perspective and how effective various management strategies are at reducing impacts. This can result in land use management that fails to protect water sources, or excessive, overly precautious restrictions on land use that unduly impact land users (see Recommendation 5).

Source protection planning for aquifers and watersheds can be an effective means of proactively addressing potential drinking water hazards in source areas before they occur. Well protection plans and integrated watershed management plans have been relatively successful where they have been undertaken. While well protection plans continue to be done, few formal planning processes for protecting surface waters have been undertaken in the past decade, even though both the *Water Act* and the *Drinking Water Protection Act* contain planning provisions. Some jurisdictions, such as Ontario, legislate planning while others do not.

In BC, recently introduced groundwater legislation improves the province's ability to manage all water resources, but the mechanisms related to groundwater management do not involve comprehensive management of groundwater extraction. While wells need to be properly constructed in order to meet the requirements of the DWPA, there is no comprehensive process, short of a water management plan, that prevents users from depleting aquifers. In addition to the risk of wells drying up, aquifer depletion can also cause streams relying on groundwater recharge to dry up, causing the loss of surface water supplies.

Land uses can also have impacts on source waters that show up several years after the activity. Government needs a better understanding of the potential impacts of activities on drinking water and about early warning indicators of adverse outcomes.

A number of additional gaps have been identified, and steps are being taken to address them:

- Mechanisms are needed to ensure water suppliers have access to information related to land use. While information management projects are underway to address this gap, it is not clear what commitment exists to ensure these projects receive adequate resources.
- Clarification is required about elements of land use legislation that protect source water.
- Clear referral processes need to be established between land use statutory decision makers and drinking water officers. A memorandum of understanding between ministries and health authorities currently being developed may ultimately provide opportunities for this clarification.
- Education of staff from the Ministries of Agriculture and Lands, Forests and Range, Environment, and Energy, Mines and Petroleum Resources on drinking water protection issues needs to be expanded to ensure they are aware of aspects of their jobs that may relate to drinking water source protection and government's commitment to integration.
- Comprehensive management plans for watersheds and groundwater recharge areas need to be supported where a need has been identified, and where procedures for developing drinking water protection plans under the *Drinking Water Protection Act* have not yet been established but could be modified from established planning processes in place under other legislation such as the *Water Act*.

- Data need to be available to allow evaluation of source management and subsequent reporting. This gap may simply require enabling access to disparate data sets or it may require identifying key data that are not being collected and ensuring that such data are collected in the future.

2.4 Recommendations

1. Provincial and federal government commitments to the Environmental Farm Plan Program should remain a priority, with a target of all farms participating in the program.
   Lead: Ministry of Agriculture and Lands.

2. The Ministry of Environment should continue to expand its activities to support drinking water officers in meeting government's source protection commitments and report out to the public on its activities. Staff at the regional level should have a clear understanding of their role in providing support to water suppliers and drinking water officers in their source protection activities.
   Lead: Ministry of Environment.

3. To ensure comprehensive management of BC's drinking water sources, especially where water quantity is threatened, government should introduce legislation requiring the licensing of groundwater extraction and restricting access to groundwater where aquifers are being over-used. Groundwater licensing should complement surface water licensing.
   Lead: Ministry of Environment.

4. Government should improve monitoring of the impacts of resource activities on drinking water sources to ensure adverse impacts on water quality can be identified. Clear responsibilities for monitoring need to be established and the parties responsible for impacts on water supplies should be held accountable.
   Leads: Ministry of Environment and Assistant Deputy Ministers' Committee on Water.

5. The Ministry of Environment and Ministry of Agriculture and Lands should work to gain a better understanding of how different land use practices can influence drinking water sources.
   Leads: Ministry of Environment, Ministry of Agriculture and Lands, Ministry of Health, and research and granting agencies.

6. Government should complete the process for water management plan development to include groundwater and surface water source areas. This process should accommodate formal planning under both the *Water Act* and the *Drinking Water Protection Act*, as well as planning occurring outside of a statutory decision. Where source water assessments show drinking water sources to be at risk from land use, or where source contamination has led to water quality advisories or identified outbreaks, watershed management plans should be developed.
   Leads: Ministry of Environment, Ministry of Health and water suppliers.

3. Integration

3.1 Context

3.1.1 Integration and Cooperation Among Multiple Players

The delivery of safe drinking water is a complex process involving many parties. Water suppliers, local governments, regional health authorities, various provincial ministries, the federal government, water agencies and First Nations all have different roles and responsibilities. With all these organizations involved in some aspect of safeguarding water quality, it is essential that structures and processes are integrated and coordinated and that all parties work together to achieve common and clearly articulated objectives. The complexity of the roles and responsibilities is such that ongoing attention to the integration and coordination of activities will always be a key focus.

Provincial Government Roles

Seven provincial ministries, including the Ministry of Health, work together to ensure the integrity of source waters and the quality of water at the consumer's tap.

- The Ministry of Environment has a stewardship role related to source water protection. It also oversees liquid and solid waste management and is responsible for land use planning activities, including how those activities address drinking water concerns. It also plays a key role in managing government water, land and resource data.
- The Ministry of Agriculture and Lands encourages the implementation of programs that aim to prevent contamination of groundwater and surface waters from livestock and farming practices. It also plays a key role in land use planning.
- Three ministries—Transportation, Forests and Range, and Energy, Mines and Petroleum Resources—are responsible for ensuring that activities such as construction of highway infrastructure, logging or mining neither degrade source waters nor introduce contaminants into the water supply. The Ministry of Transportation plays a lead role in subdivision approval, which is a critical step in the creation of new public water supply systems. Transportation systems, such as roads and highways, can also impact source water quality.
- The Ministry of Community Services is the lead funding organization for water system planning and infrastructure improvements. It oversees BC's role in the Canada-BC Infrastructure Grant Program and manages the new BC Community Water Improvement Program (see Section 5.3.2).

A number of Crown corporations, such as BC Hydro and BC Building Corporation, operate public water supply systems or manage land or water uses that can potentially influence source water quality.

Federal Government Roles

The Government of Canada is responsible for a wide range of water supply systems under federal jurisdiction in British Columbia. These systems include those in national parks, federal penitentiaries, port authorities, military bases, some airports and vessels or common carriers such as ferries and airplanes. There is a patchwork of legislation governing these water supplies, including regulations under the *Canada Labour Code* and the federal *Department of Health Act*.

First Nations Water Systems[17]

There are about 302 First Nations community water supply systems in BC. These systems fall under the jurisdiction of the local First Nation. Federal environmental health officers (EHOs) carry out monitoring of these systems. Indian and Northern Affairs Canada (INAC) provides funding to assist First Nations in the design, construction and operation of water and sewer services. Funding is also available to provide water filtration treatment. There are now 35 surface water filtration plants and five groundwater treatment systems on First Nation reserves.

While bands ultimately make the decision about how to manage their water supply systems, the programs that are in place on reserves in BC are similar to those in place off-reserve. For instance, INAC has undertaken engineering assessments of most water supply systems on-reserve that serve more than three homes (one band chose not to participate in the assessments). For all First Nations' water supply systems, INAC has committed to filtering all surface water sources and meeting the criteria set out in the *Guidelines for Canadian Drinking Water Quality*.

3.1.2 Number of Systems

One of the greatest challenges to ensuring the quality of drinking water in BC is the sheer number of public water supply systems in the province. Exact numbers are difficult to confirm, but a tally by regional health authorities of the number of known public water supply systems—supplies that provide water for domestic purposes to anything other than a single family dwelling—shows almost 4,000 different public water supply systems of varying sizes. There are also as many as 80,000 private wells and at least 18,000 surface water licenses supplying single family dwellings. These private systems are not fully regulated under the DWPA.[18]

The number of identified public water supply systems in BC has more than tripled since 1989 and continues to grow. Public water supply systems range in size from the large municipal systems, such as the Greater Vancouver Regional District serving more than 600,000 connections and the Capital Regional District serving some 200,000 connections,[19] to single connection systems serving a public facility such as a park, restaurant or logging camp. As of March 31, 2004, health authority records had identified 3,957[20] public water supply systems in BC (see Table 6).

It should be noted that all health authorities caution that their records still under-report small and as-yet-unidentified systems in BC. The above count also does not include the 302 systems on First Nations reserves, which would bring the total number of identified systems in British Columbia to approximately 4,259.[21]

Table 6: Number of public water supply systems identified by health authority as of December 31, 2003 (excluding First Nations systems)

	Vancouver/Coastal	Vancouver Island	Interior	Fraser	Northern	Total
> 300 connections	23	53	83	27	37	223
15-300 connections	68	189	451	103	132	943
2-14 connections	144	266	883	178	442	2,791
1 public connection		316		171	391	
Total	235	824	1417	479	1002	**3,957**

[17] *Information about First Nations water systems has been provided by Indian and Northern Affairs Canada.*

[18] *While Section 23 of the* Drinking Water Protection Act *prohibits the contamination of domestic private water supply systems, the systems themselves are not actively regulated.*

[19] *Within the overall distribution networks of the Greater Vancouver Regional District and the Capital Regional District, many municipalities are the suppliers actually responsible for water quality at the consumer's tap, but the two regional districts provide treatment for the two regions.*

[20] *Note: Duplications and errors exist in this record, with many systems entered into databases more than once. A mail out to all suppliers on record in BC resulted in approximately 300 letters being returned.*

Ninety-six of these supplies represent the largest municipal systems and serve more than 90 per cent of the population. The remaining 10 per cent of the population is served by more than 4,000 smaller systems.

3.1.3 Laboratory Testing

Water samples collected for bacteriological analysis are time-sensitive and laboratories must begin to analyze them within 30 hours of collection (American Public Health Association, 2005). In most areas of BC, water samples are tested well within this time limit. However, distance is a challenge in some remote areas and communities may have difficulty getting samples to an approved laboratory in a timely manner. Difficulty in accessing laboratories is particularly problematic in the North and some areas in the Kootenays, although through increased Ministry of Health funding to support the EWQA Program in 2003, the number of approved laboratories has increased, including laboratories in Alberta, which may be easier to access in this part of BC. The need to encourage a broader network of approved labs remains a priority for the BCCDC and the EWQA Program.

British Columbia Centre for Disease Control

The British Columbia Centre for Disease Control (BCCDC) is an organization within the Provincial Health Services Authority, responsible for supporting a comprehensive program of communicable disease prevention and environmental health control. BCCDC Laboratory and Epidemiology Services staff and program experts provide consultations and advice on environmental microbiology issues, provide monitoring support, particularly for small systems, carry out specialty tests (including complex, labour-intensive tests for specific waterborne pathogens), assist in waterborne disease outbreak detection and investigation, provide public health audit testing, investigate associated clinical diseases, and conduct public health research. Staff are also leaders in the EWQA Program. Radiation Protection Services provides advice on the significance of radioactive elements in water supplies, and the Environmental and Toxicology Consultation Group provides advice on the significance of chemical and other contaminants. The BCCDC's laboratory and epidemiological standards of excellence have been recognized across Canada. For more information about the BCCDC, see Section 1.1.

Enhanced Water Quality Assurance Program

The EWQA Program ensures laboratory standards are met and makes recommendations to the Provincial Health Officer for the approval of laboratories to conduct microbiological water quality testing. In addition to making recommendations to the Provincial Health Officer, the EWQA Program evaluates test methods against internationally-recognized standards, evaluates the use of these methods by laboratories and conducts laboratory inspections.

3.2 Accountability

Figure 12 shows how the accountability framework discussed in the introduction applies to principle 3 of the Action Plan for Safe Drinking Water in British Columbia: "providing safe drinking water requires an integrated approach." Progress and accomplishments related to each component are discussed in Section 3.3.

3.3 Progress and Accomplishments 2003/2004 and 2004/2005

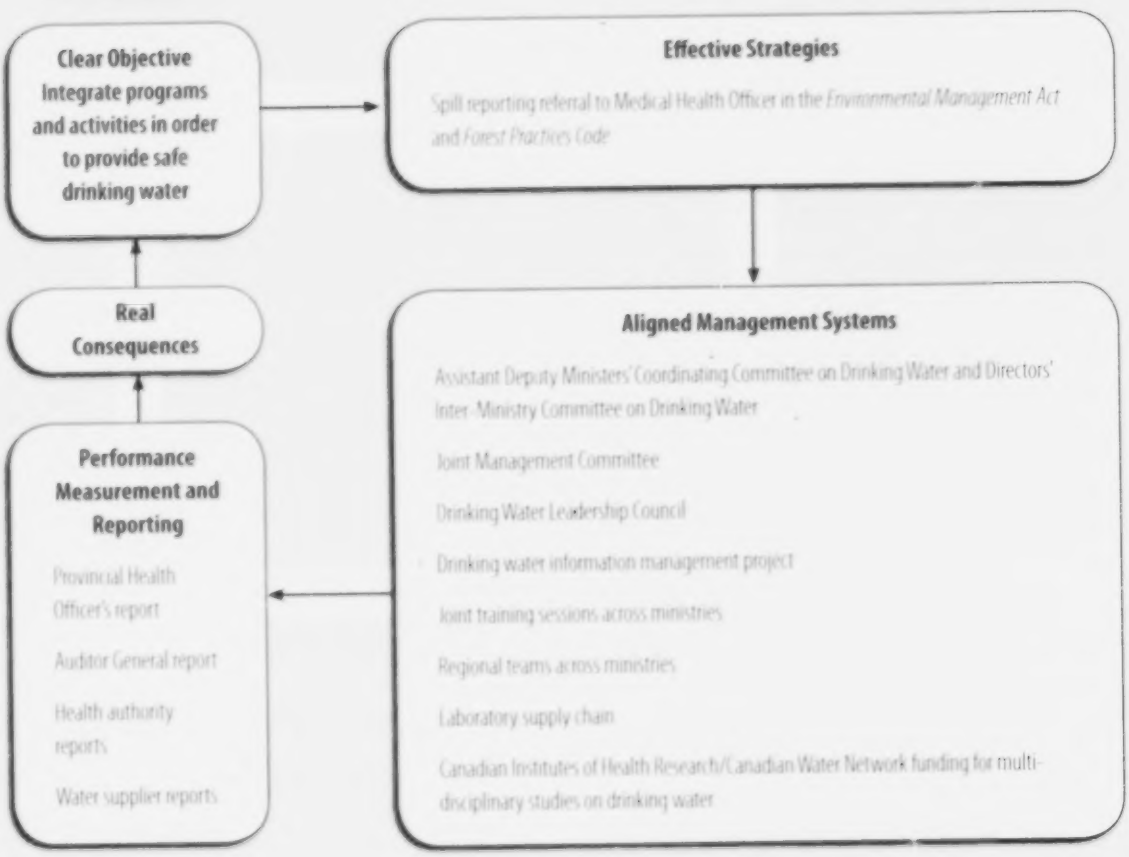
3.3.1 Effective Strategies

Governments across the country face the challenge of needing a clearly identified lead agency for regulating drinking water and coordinating all other agencies whose policies or programs could have an impact on water supply systems.

In its Action Plan for Safe Drinking Water in British Columbia, the provincial government identified the Ministry of Health as BC's lead agency for drinking water issues and committed other government ministries to adopting an integrated approach to drinking water protection and management. In addition to this general directive, specific directives were made to the Ministry of Environment.

A key element in integrating activities across government ministries is the ability to access relevant data. In support of information management needs, the Ministry of Health spent more than $100,000 in 2003/2004 and more than $500,000 in 2004/2005.

Figure 12 **Principle 3: Providing safe drinking water requires an integrated approach**


Clear Objective
Integrate programs and activities in order to provide safe drinking water
Effective Strategies
Spill reporting referral to Medical Health Officer in the Environmental Management Act and Forest Practices Code
Aligned Management Systems
Assistant Deputy Ministers' Coordinating Committee on Drinking Water and Directors' Inter-Ministry Committee on Drinking Water
Joint Management Committee
Drinking Water Leadership Council
Drinking water information management project
Joint training sessions across ministries
Regional teams across ministries
Laboratory supply chain
Canadian Institutes of Health Research/Canadian Water Network funding for multi-disciplinary studies on drinking water
Performance Measurement and Reporting
Provincial Health Officer's report
Auditor General report
Health authority reports
Water supplier reports
Real Consequences

3.3.2 Aligned Management Systems

To ensure accountability for the integration of programs and activities that deal with drinking water issues, several committees have been established, as have relationships between the Ministry of Health and other existing coordinating committees. These committees coordinate programs and policies across provincial government departments (one at the level of Assistant Deputy Ministers and the others at the Director level) and with drinking water officers from the regional health authorities (Drinking Water Leadership Council).

Provincial Coordinating Bodies

Three interlinked committees have been established to oversee and direct activities—from high-level policy decisions to day-to-day actions.

Assistant Deputy Ministers' Coordinating Committee on Drinking Water (ADMCC):[21] The ministries with an interest in drinking water represented in the ADMCC are:[22]

- Agriculture and Lands
- Community Services

[21] *As of 2006, this committee is now the Assistant Deputy Ministers' Committee on Water and is led by the Ministry of Environment.*

[22] *Since 2005/2006, the BC government has reorganized and renamed many of its ministries. The new names can be found in Appendix G. Land & Water British Columbia, Inc. and the Ministry of Sustainable Resource Management were originally part of the ADMCC, but both organizations' activities have since been divided among other government ministries, such as the new Ministry of Environment.*

- Energy, Mines and Petroleum Resources
- Forests and Range
- Health
- Transportation
- Environment

The ADMCC is led by the Ministry of Health. Its role is to advise government and develop high-level, coordinated government policy to protect drinking water from source to tap. It ensures that higher level government policy decisions consider and give priority to the protection of human health in relation to drinking water. It also steers the work of the Directors' Inter-Ministry Committee on Drinking Water and other related working groups. The ADMCC has been meeting regularly since June 2002, providing high-level direction to staff within the respective ministries as well as policy advice during the development of legislation and policies that support the Action Plan for Safe Drinking Water in British Columbia.

Directors' Inter-Ministry Committee on Drinking Water: The same ministries from the ADMCC are represented on this committee, but at the level of the directors who have day-to-day responsibility for the administration of programs that can influence the safety of drinking water—either at the source or during treatment and distribution. Also led by the Ministry of Health, this committee's role is to ensure high-level policies are reflected in actions and programs. The committee meets monthly. In 2003/2004, the committee oversaw the development of the source-to-tap screening tool (see Section 4.3.2), coordinated multi-ministry involvement in the drinking water information management project (see Section 3.3.2), coordinated a review of small public water supply systems (see Section 7.3.2) and facilitated the coordination of field staff activities.

In 2004/2005, the committee continued to support water supply system assessments by working to develop a comprehensive source-to-tap assessment guideline (see Section 4.3.2), maintaining coordination of the drinking water information management project (including initiating a business analysis of the various ministries' activities related to drinking water) and initiating the development of a Memorandum of Understanding that will detail expectations for coordination and referrals between ministry staff and drinking water officers.

Drinking Water Leadership Council (DWLC): This council serves as the single point of contact on drinking water issues for the Ministry of Health and the drinking water officers in the regional health authorities. This council:

- Brings guidelines and policy directions into action in the field.
- Coordinates training and education opportunities and general information sharing for drinking water officers.
- Advises the Ministry of Health about issues in the regions to inform government processes at the higher levels.

The members of this council represent the drinking water officers (including Medical Health Officers, public health engineers and public health inspectors) from each of the five regional health authorities as well as representatives from the Office of the Provincial Health Officer, the Ministry of Health and the Ministry of Environment. The council supports and facilitates leadership on drinking water issues and coordinates the implementation of the *Drinking Water Protection Act*.

The DWLC is intended to promote the use of an accepted common set of practices among drinking water officers across the province to guide their actions and activities.

Joint Management Committee: This committee coordinates activities under the *Forest Practices Code Act* and the *Forest and Range Practices Act*. The Ministry of Health is represented on this committee in order to provide input into policies that could affect drinking water sources.

Federal-Provincial-Territorial Coordinating Bodies

In addition to the above committees that operate at the provincial level, BC is actively involved in a number of national committees that coordinate drinking water activities across the country. These committees include the Federal-Provincial-Territorial Committee on Health and Environment and the Federal-Provincial-Territorial Committee on Drinking Water (CDW). These committees establish the *Guidelines for Canadian Drinking Water Quality*, published by Health Canada. The CDW also sponsors a national drinking water conference every two years which brings together experts to share the latest research and activities related to drinking

water quality and management. For information about these committees, see the Health Canada website at http://www.hc-sc.gc.ca/waterquality.

Drinking Water Information Management Project

Collecting meaningful and relevant data about the thousands of public water supply systems in BC is a daunting task. To date, efforts to manage and monitor provincial drinking water issues has been hampered by the lack of basic, easily-accessed data and the lack of coordination of information collection and sharing. Two data management systems are being used by the five health authorities. These systems were both undergoing modifications during the reporting period. Much of the data needed to report out on activities under the *Drinking Water Protection Act* were not being collected, or entered into either system. In order to address this significant challenge, the provincial government, health authorities and water suppliers have started to align their management systems to integrate programs and activities through a drinking water information management project initiated in 2003.

Overall, the project aims to meet drinking water information needs and to support decision making and accountability by creating a standardized, effective information management system for use by the Provincial Health Officer, affected ministries, regional health authorities, water suppliers and laboratories. It will also help public water supply systems operate more effectively and provide industry and local governments with access to data that would give them greater awareness of where water supplies are located to help them with responsible land use planning. This project is intended to eventually translate into an online tool for collecting and reporting water quality and associated data in a meaningful manner.

The three primary objectives of the project are to:

1. Improve the ability to access and analyse data related to drinking water in BC.
2. Provide partners and stakeholders with relevant information in a timely manner to assist in decision making and reporting.
3. Support the implementation of the *Drinking Water Protection Act*.

In order to proceed, it has been necessary to develop a standardized, core data set for all public water supply systems in the province. This core data set is needed by the regional health authorities and government to administer and report on activities under the *Drinking Water Protection Act*. The data set will form the basis of an online database that will allow stakeholders to input data and access the information they need. The core data to be included are defined by the reporting requirements of the *Drinking Water Protection Act* and identified by the Provincial Health Officer, Ministry of Health staff and staff from other ministries and the health authorities. Stakeholder input is key to determining which data are required and available.

Unfortunately, in 2003/2004 and 2004/2005 progress in developing the core data set was hampered by the fact that stakeholders did not have a clear understanding of their responsibilities related to the *Drinking Water Protection Act* or the Action Plan for Safe Drinking Water in British Columbia. This situation was compounded by the fact that very little quality data were available across the multiple database systems in use across government. The available data have turned out to be difficult to evaluate because the databases were incomplete and some of the data that were collected had not been validated. Data were inconsistent across regions, presented in varying formats, and were sometimes inaccessible electronically. Finally, the information systems that have traditionally housed this data were not all robust or flexible enough to interact with other systems via the Internet.

These significant challenges meant that the scope and timelines of the drinking water information management project increased substantially since its inception. Between 2003 and 2005, the project's Technical and Business Steering Group focused its attention on working with the health authorities and the Provincial Health Officer to analyse their business needs. This business analysis resulted in the development of a draft core data set which will be expanded with input from partner ministries. The draft data set identifies the specific types of data that will need to be collected in order for the provincial government, health authorities and water suppliers to do their jobs and meet the requirements of the DWPA and the Action Plan for Safe Drinking Water in British Columbia.

In 2004/2005, a "proof of concept" project was undertaken, to develop a demonstration system that incorporated data from a number of sources to show how the information gathered under the drinking water information management project could be integrated to support water supply management. The proof of concept project supports the continued effort to link the many disparate data sets within government and the health authorities in order to improve decision makers' ability to protect drinking water sources and manage water supply systems (see Recommendation 7).

Joint Training Sessions Across Ministries

Government is also aligning its management systems through cross-ministry job training sessions and through the creation of regional teams made up of staff from across ministries.

In 2003/2004, a joint training session was held with drinking water officers and Ministry of Environment staff in an effort to improve coordination of their activities. Building on this province-wide session, individual regions have been coordinating local program development.

Training and education opportunities for other government agencies and client groups are being considered.

BCCDC Laboratory Services Supply Chain Analysis

In 2004, the BCCDC conducted an analysis of the supply chain for drinking water samples. The analysis looked at the flow of drinking water samples from the locations where samples are taken until they arrive at the testing facilities. A perfect supply chain would have the right number of water samples arriving at the testing facility at the specified times using the most economical transportation and delivery methods. The analysis revealed a number of challenges in BC, including a lack of ownership of the overall management of the supply chain, poorly defined expectations at each point in the chain, a lack of contingency plans and a need for delivery service protocols and standards. It also pointed to the need for short-term solutions for both the North East and East Kootenay regions where the transportation times for water samples reaching approved laboratories are often unacceptably high, meaning that the sample often cannot be tested.

Legislative Amendments

The Environmental Management Act and the *Forest Practices Code of British Columbia Act* have both been amended to include provisions that require contaminant spills to be reported to the Medical Health Officer.

3.3.3 Performance Measurement and Reporting

As noted in earlier sections, the performance of the provincial government, health authorities and water suppliers in this area is measured and reported through reports such as this one.

In 2004, BCCDC prepared a report about its analysis that presented a blueprint for developing a supply chain strategy. This report encouraged integration and coordination throughout the supply chain, including alignment with the network of laboratories approved by the Provincial Health Officer.

As mentioned, a key component of the drinking water information management project is to develop a core data set needed by health authorities and government to administer the *Drinking Water Protection Act*. This core data set will allow consistent reporting of activities under the Act in future years.

Despite clearly recognizing the need for an integrated approach across all government ministries and agencies that have legislated authority for water protection from source to tap, the details of what this means and the consequences of it not being achieved are not clearly articulated. As a result, it is difficult to assess and report on performance in this area.

Reported Concerns

A number of incidents were reported in an ad hoc manner during the 2003/2004 and 2005/2006 fiscal years to drinking water officers, the Directors' Inter-Ministry Committee on Drinking Water and directly to the Office of the Provincial Health Officer. One of the most common concerns expressed by agencies involved with resource development, both from the industrial sector and from government regulators, is the difficulty in identifying when a proposed activity might have an impact on a water supplier. Conversely, water suppliers frequently complain that resource management decisions have been made that affect their watersheds or well recharge areas without consulting either the water suppliers or the appropriate drinking water officer. These incidents have demonstrated that there is room for improvement in terms of coordinating efforts across government. Such improvements

will benefit the management of drinking water programs and will also improve resource development and industry by clarifying the expectations of drinking water officers and water suppliers.

The ramifications of such uncertainties are generally unclear but have the potential to adversely impact either water quality or access to resources. For example, in the case of a proposed gravel pit operation in the Sunshine Coast, concerns were raised that the water source could be jeopardized. Most agencies felt that the proposed activity was relatively benign, however a source assessment was requested to evaluate the concern. Potential impacts of the proposal were reviewed during the assessment, resulting in lengthy delays for the permit applicant waiting for a decision on the application.

Another concern comes from the fact that requirements of the *Water Utility Act* do not apply to systems serving fewer than five connections. Anecdotal reports suggest that some developers may choose to create multiple water systems serving fewer than five connections each, rather than one large system, in order to avoid requirements under the *Water Utility Act*. While it is reasonable to reduce the regulatory burden for very small water supply systems, this approach may have had the inadvertent effect of encouraging the creation of multiple small systems likely to pose long-term difficulties under the DWPA for the eventual owners of the systems, consumers and drinking water officers. For more information on this type of situation, see "Privately Owned Water Supply Systems" under Section 7.3.4.

In a third case, area residents opposed a proposed logging operation in the Okanagan because of concerns that the operation would impact their water supplies. The applicant, local Ministry of Forests and Range staff and area residents expended considerable effort discussing the concerns, until the drinking water officer for the area was consulted, assessed the situation and concluded that the proposed activity would not result in a drinking water health hazard. While the area residents retained concerns about the application, the question regarding water quality could have been more quickly resolved with improved referral protocols.

Also in the Okanagan, a study was completed in 2004 that looked at the potential impacts on water quality related to the intended sale of waterfront lots on Crown Land that the provincial government had previously leased out. An assessment of water quality impacts was completed based on field observations and other reports. The study found that the sites at that time did not have a discernable impact on water quality. It made a series of recommendations on how to ensure continued minimal impact on water quality from the sale of the land, should that course of action be pursued.

3.3.4 Gaps

The provincial government, health authorities and water suppliers are challenged in their ability to meet the objective of integrating programs and activities due to the following gaps:

- The absence of clear procedures between decision makers in different ministries for referrals and routine business. Many government referral structures have not historically involved staff in the regional health authorities in resource management decisions that may affect drinking water quality. Legislation governing land use generally does not include an internal mandated referral process involving health authorities,[25] and government officials must ensure that appropriate referrals take place as a routine part of business regardless of statutory mandate (see Recommendation 8).
- Ready access to data about water supplies that could improve land use decisions and information about land uses that could help water suppliers and drinking water officers in their efforts to manage risks to source water. These information gaps are intended to be addressed through the drinking water information management project (see Recommendation 9).

[25] *"Internal mandated referral process" is where a piece of legislation names the decision maker in another ministry who then has to review the decision or provide advice. Currently, the different ministries and levels of government are expected to work with one another when necessary, without needing this collaboration imposed by legislation.*

3.4 Recommendations

7. The systematic collection of better information about drinking water quality conditions in the province is needed. The drinking water information management project needs to be completed to ensure drinking water officers and the Provincial Health Officer have ready access to all data needed to administer and report on activities under the *Drinking Water Protection Act*. These data include those needed to hold water suppliers, drinking water officers and the government accountable through public reporting.
   Leads: Ministry of Health and Ministry of Environment.

8. Where government activities affect the safety of drinking water, the decision makers responsible for the activity must ensure that they involve the appropriate health officials, either within the Ministry of Health or within the regional health authority.[23]
   Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water.

9. All ministries and government agencies should regularly review their activities in the context of government's commitment to an integrated approach to drinking water protection.
   Lead: Directors' Inter-Ministry Committee on Drinking Water.

10. All government policy decisions related to land use or water management which could have an impact on the province's drinking water program should be taken to the Assistant Deputy Ministers' Committee on Water to ensure that policy direction is consistent with the Action Plan for Safe Drinking Water in British Columbia. The work of the Committee should be made more transparent; its decisions should be made publicly available.
    Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water.

[23] *As of October 2006, a Memorandum of Understanding was being developed.*

4 Water System Assessments

4.1 Context

While not required by regulations, the Action Plan for Safe Drinking Water in British Columbia recommends that all public water supply systems in the province undergo a source-to-tap assessment. These assessments should identify potential health hazards and help drinking water officers and suppliers prioritize actions to address any weaknesses in the system. To date, 3,001 of 3,957 public water systems in the province have undergone at least a basic assessment using a high-medium-low hazard rating system (see Appendix A).

An assessment identifies the critical points where the water system is or may be vulnerable to chemical, physical or microbiological contamination. The results of the assessment help to identify which protective measures should be taken in order to reduce or eliminate hazards. In addition, assessments can indicate areas where water quality can be improved by optimizing existing treatment processes or making other adjustments.

Hazards can come from the contamination of source waters, inadequate treatment, treatment failures, poorly constructed or maintained distribution systems, cross-connections within the distribution system and improper operation. For instance, water quality can deteriorate because of stagnation in water mains or storage reservoirs. All public water supply systems are subject to some of these hazards; in some cases, all of these hazards may be a concern.

Assessments help water suppliers and drinking water officers identify hazards associated with their systems and take steps to reduce or eliminate them. They provide the information required to target improvements where they will do the most good and to continually improve safety for consumers. Assessments also help the regional health authorities set priorities and focus their attention and resources on the highest risk systems that impact the greatest number of people. Assessments are expected to identify the need to improve some of the province's treatment and distribution systems.

If a risk to public health is suspected, a drinking water officer may decide to order an assessment to be done. Part 3 of the *Drinking Water Protection Act* (DWPA) gives this power to drinking water officers. If a water supplier is reluctant, the Act provides specific powers to drinking water officers to order the owner to undertake an assessment.

The Act defines the purpose of an assessment as identifying, inventorying and assessing:

a) the drinking water source for the water supply system, including land use and other activities and conditions that may affect that source,

b) the water supply system, including treatment and operation,

c) monitoring requirements for the drinking water source and water supply system, and

d) threats to drinking water that is provided by the system.

The Act relies on the drinking water officer, working with the water supplier, to establish the specific requirements of a given assessment. Assessments may be quite basic, involving the use of the Drinking Water Source-to-Tap Screening Tool (available at http://www.health.gov.bc.ca/protect/dwpublications.html), which consists of 97

questions related to administration, management, operation and description of the water system, water source, water treatment, water storage, distribution and tap water quality. Using the screening tool can be a desktop exercise taking less than a day to complete. It is intended to quickly identify key aspects of a water supply system that may require more in-depth assessment. On the basis of information provided by use of the screening tool, or based on drinking water officer inspections, a more comprehensive assessment may be required. A comprehensive assessment may involve a detailed evaluation of the entire water supply system or specific elements.

Section 22 of the Act requires water suppliers to develop an assessment response plan once an assessment has been completed. These response plans should flow naturally from the assessments, addressing each identified hazard, providing options for corrective actions and time frames for completion.

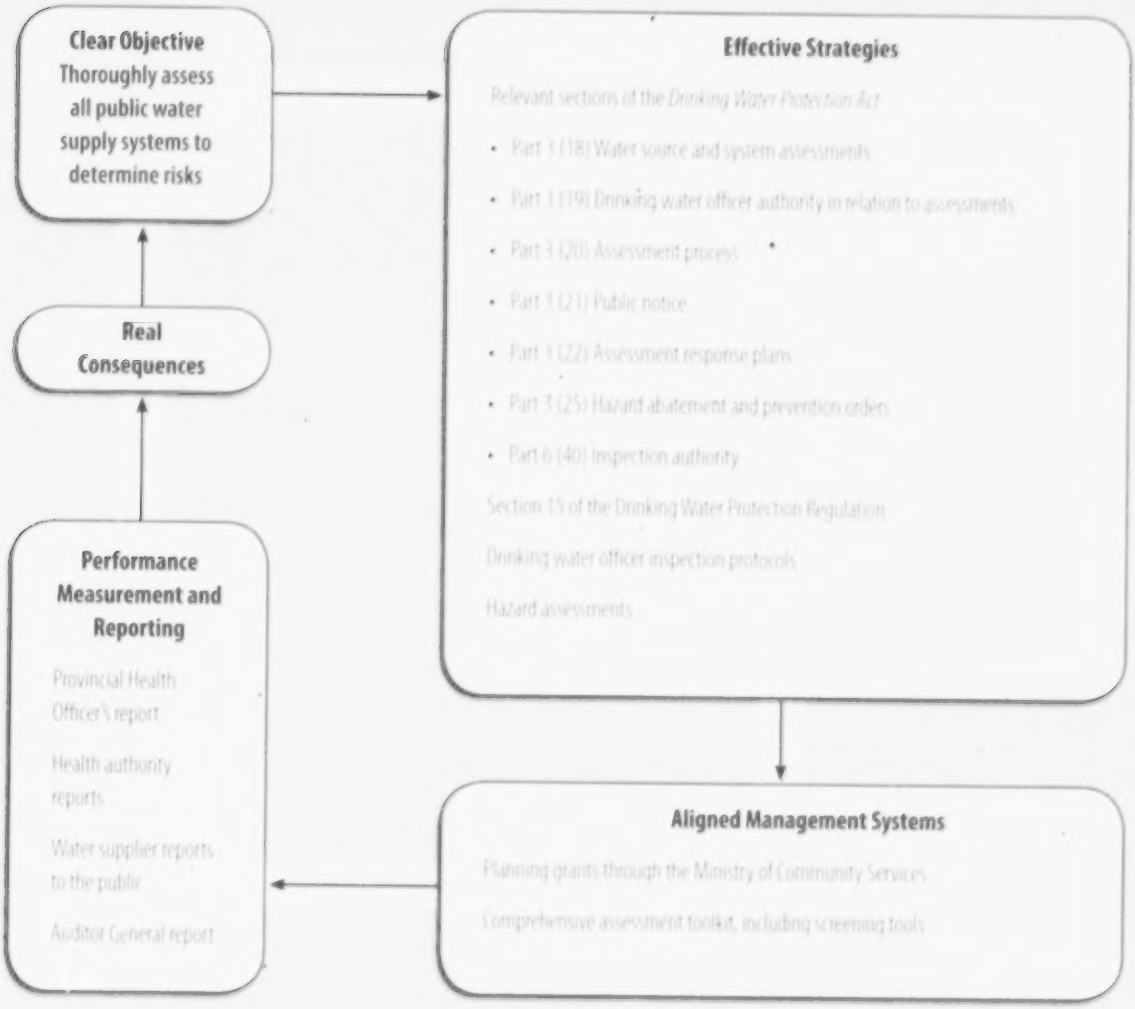
Section 40 of the Act enables drinking water officers to inspect public water supply systems.

A large number of resources are readily available to help suppliers comply with the DWPA. These resources include technical documents for conducting specific assessments of water supply systems on topics such as leak detection, infrastructure integrity, cross-connection identification and treatment effectiveness. Professionals are also available to help suppliers conduct the assessments. Similarly, extensive resources are available to help suppliers respond to any hazards identified during the assessment process.

Some of the available resources include:

- The Well Protection Toolkit, a joint publication of the Ministry of Environment, Ministry of Health and Ministry of Municipal Affairs, with support from Environment Canada and the British Columbia Ground Water Association. This publication guides water suppliers through the process of developing a comprehensive well protection program which includes identifying the source area, assessing threats in that area and developing appropriate management and mitigation strategies.
- A series of best management practice (BMP) documents for water suppliers in BC, developed by the British Columbia Water & Waste Association (BCWWA) in conjunction with the Ministry of Health, drinking water officers and water supply professionals. Topics include: cross-connection controls, chlorine disinfection and monitoring, distribution system renewal planning, emergency response planning, reducing distribution system water losses, turbidity monitoring and reporting and distribution system cleaning. These BMPs can be accessed through the BCWWA website at http://www.bcwwa.org.
- National best practices guides developed through InfraGuide, the National Guide to Sustainable Municipal Infrastructure. These guidance documents deal with topics such as water metering, inspections, water quality in the distribution system, small systems operation and maintenance and system repairs. They are available on the web at http://www.InfraGuide.ca.
- A useful guide to managing drinking water supplies from source to tap, developed jointly by the Federal-Provincial-Territorial Committee on Drinking Water (CDW) and the Canadian Council of Ministers of the Environment. This document is available online at http://www.ccme.ca/assets/pdf/mlxa_guidance_doc_e.pdf.
- The *Guidelines for Canadian Drinking Water Quality*, developed by the CDW and published by Health Canada. These guidelines include operational guidelines related to treatment, such as turbidity and corrosion control (under development). The guidelines can be accessed through Health Canada's website at http://www.hc-sc.gc.ca/waterquality.
- The United States Environmental Protection Agency's guidelines, standards and guidance, including its Surface Water Treatment Rule. Water professionals and regulators in Canada regularly refer to these materials (see http://www.epa.gov/ow).
- The American Water Works Association (AWWA) has produced many documents that complement Canadian guidance documents (see http://www.awwa.org).

Figure 13 **Principle 4: All public water supply systems need to be thoroughly assessed to determine risks**


Clear Objective
Thoroughly assess all public water supply systems to determine risks
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 1 (18) Water source and system assessments
• Part 1 (19) Drinking water officer authority in relation to assessments
• Part 3 (20) Assessment process
• Part 3 (21) Public notice
• Part 3 (22) Assessment response plans
• Part 3 (25) Hazard abatement and prevention orders
• Part 6 (40) Inspection authority
Section 15 of the Drinking Water Protection Regulation
Drinking water officer inspection protocols
Hazard assessments
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Health authority reports
Water supplier reports to the public
Auditor General report
Aligned Management Systems
Planning grants through the Ministry of Community Services
Comprehensive assessment toolkit, including screening tools

4.2 Accountability

Figure 13 shows how the accountability framework discussed in the introduction applies to principle 4 of the Action Plan for Safe Drinking Water in British Columbia: "all public water supply systems need to be thoroughly assessed to determine risks." Progress and accomplishments related to each component are discussed in Section 4.3.

4.3 Progress and Accomplishments 2003/2004 and 2004/2005

4.3.1 Effective Strategies

A number of strategies are in place to help water suppliers meet the objective of thoroughly assessing all public water supply systems in the province. These strategies include provisions in Part 3 of the DWPA that describe the assessment process and the authority vested in drinking water officers to order the completion of assessments. Section 15 of the Drinking Water Protection Regulation deals with assessment response plans.

The DWPA deliberately does not define what constitutes an assessment since it is expected that assessments will take many forms: from a formal inspection by a drinking water officer, to a supplier going through a checklist, to a professional consultant's evaluation. Assessments may cover all aspects of a public water supply system from source to tap, or may focus on addressing key areas where information is needed to help water suppliers and drinking water officers make specific decisions. The key is to ensure all hazards are identified and plans are put in place to correct them.

The Action Plan for Safe Drinking Water in British Columbia calls for all public water supply systems to be assessed. The provincial government is committed to providing tools to the water industry to support this work. Tools developed during the reporting period are listed in Section 4.3.2.

4.3.2 Aligned Management Systems

The provincial government, health authorities and water suppliers have started to align their management systems to support the assessment process. For instance, they have begun developing assessment tools and templates for use by the range of stakeholders involved in conducting assessments (drinking water officers, public health engineers, water suppliers, consultants and so on).

In 2003/2004 and 2004/2005 all health authorities evaluated their inspection strategies, their approaches to having water suppliers conduct assessments and their data management capabilities. Over 2004/2005 the foundations of a core data set were identified through a project involving all health authorities. Core data are the key data needed for every public water supply in the province. Based on these evaluations and the core data set project, all health authorities have implemented steps to undertake assessments and improve the information available about water supplies in their jurisdiction.

A pilot project was undertaken jointly by the Ministries of Environment and Health and the Interior Health Authority to conduct system assessments and manage assessment data. Data were collected for 285 public water systems. Results from this pilot project have been submitted to the ministries and the health authority to assist them in refining assessment processes and data management capabilities.

Assessment Tools

Through the inspection process undertaken by drinking water officers, 3,001 public water supply systems had been assigned a hazard rating by the end of 2003/2004. Most larger public water supply systems had undertaken some form of additional assessment as a routine part of operation. Larger water suppliers have professional staff or consultants regularly assessing their systems. These assessments routinely involve inspections for cross-connections and leaks, and inspection of the general integrity of the distribution system (such as evaluating the condition of water mains and storage reservoirs). These programs are complemented by routine maintenance to install or replace cross-connection control devices, fix or replace leaky valves, fix hydrants or pipes, flush water mains to remove sediment build-up and clean and maintain water storage reservoirs.

In 2003/2004 and 2004/2005, no systematic assessment tool was applied to all public water supply systems and no standardized assessment tool was used by all water suppliers in all health authorities across the province. Smaller public

water supply systems may not have in-house expertise or their owners may not be aware of the need for either routine or comprehensive assessments.

To assist with the assessment process, an inter-ministerial team worked on developing the following tools in 2003/2004 and 2004/2005:

- Drinking Water Source-to-Tap Screening Tool: This tool was designed to take water suppliers through a step-by-step analysis of their system to flag deficiencies and concerns. It was primarily developed to help small public water supply systems conduct a hazard assessment. The screening tool is available online at http://www.health.gov.bc.ca/protect/pdf/BC_Drinking_Water_Screening_Tool.pdf.
- Comprehensive Source-to-Tap Assessment Guideline: An in-depth assessment guideline has been drafted for professional engineers, consultants and water suppliers to conduct detailed assessments of more complex public water supply systems.
- Assessment Response Plan Template: Once an assessment has been conducted, the Assessment Response Plan Template will help formulate a prioritized response plan. This template is under development.

The results of assessments lead to the identification of needs, such as upgrades to treatment and distribution systems. These infrastructure improvements are funded in part by the Canada-British Columbia Infrastructure Program, where the system is owned by local government and by ratepayers. For more information, see Section 5.3.2 "Infrastructure Improvements."

4.3.3 Performance Measurement and Reporting

Between 2003 and the end of 2004/2005, the health authorities developed and began implementing strategies to have all water supply systems assessed. These strategies involved a combination of water supplier-led assessments and inspections done by drinking water officers.

In 2003/2004, the need for one Vancouver Island public water supply system to identify priority risk factors led to the drinking water officer issuing an order to the supplier to undertake an assessment. In 2004/2005, another assessment order was issued by a Vancouver Coastal Health Authority drinking water officer in response to concerns related to proposed land use activity in the watershed.

In 2003/2004, water suppliers and drinking water officers assessed the majority of public drinking water supply systems in the province. Of a total of 3,957 systems, 3,001 were assessed. Of these, 1,617 were determined to present a low level of risk and 1,065 a medium level of risk. Of the 319 systems that were determined to be at high risk for health hazards, 317 were small systems, each serving fewer than 300 connections. A breakdown of the assessment results are presented in Appendix A.

It is important to remember that a high-risk rating for a water system does not necessarily mean that public health is threatened since strategies such as a boil water advisory may be in place as a precautionary measure.

In 2004/2005, assessment activities continued. By the end of the period in the Vancouver Island Health Authority, all water systems had been assigned a hazard rating using the Hazard Rating Tool provided in the *Drinking Water Officers' Guide*. In the Fraser Health Authority, all 494 public water supply systems had been assessed, and in the Interior Health Authority 1,347 of 1,634 systems had undergone hazard identifications and risk assessments. In the Northern Health Authority, 960 water systems had been assessed using the hazard rating tool in the *Drinking Water Officers' Guide*. In the Vancouver Coastal Health Authority, 13 source assessments were conducted by a contractor during 2004/2005.

4.3.4 Gaps

One of the greatest challenges to assessing all public water supply systems in the province is the sheer number of systems requiring inspection and assessment combined with the limited financial resources available. Systems owned by local governments generally benefit from in-house expertise and economies of scale, and can access federal-provincial infrastructure funding. Other systems frequently lack expert staff and funds for engaging external professional assistance. This situation will be improved once the assessment tools

and templates are completed, though the capacity of health authorities and water suppliers to do the assessments will remain a challenge.

Currently, no comprehensive database exists for recording the results of assessments. Data exist in a mix of water supplier and health authority databases and paper-based reports. Data about the location of potential sources of contamination for water sources exist in databases maintained by several government ministries, but are not readily accessible to water suppliers or drinking water officers in an electronic format clearly linked to the assessment process (for instance, waste discharges permitted by the Ministry of Environment may not be readily available to water suppliers taking water downstream from a discharge, nor will the Ministry of Environment, nor the person discharging the waste, necessarily have information about the existence of a downstream water intake).

The drinking water information management project is intended to address the need for data management systems to ensure water suppliers have access to relevant information. It should also enable them to do comprehensive public reporting. Water suppliers also need mechanisms to alert them to potential changes to land use that could affect water sources.

4.4 Recommendations

11. All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans health authorities should require water suppliers relying on surface water sources to plan for treatment capable of achieving 99.99 per cent reduction in virus levels, 99.9 per cent reduction in protozoa levels and turbidity levels below 1NTU, through treatment processes involving at least two barriers, unless there is good justification, acceptable to the Drinking Water Officer, for not achieving those levels.

Lead: Health authorities.

5. Water Treatment and Distribution

5.1 Context

5.1.1 Water Treatment

Most British Columbians live in larger cities serviced by good water treatment plants and distribution systems. They can expect to receive reliably high-quality drinking water. However, as noted in the 2000 Provincial Health Officer's Annual Report (2001), the province has a history of under-treating its water compared to other jurisdictions. In particular, a significant number of small public water supply systems that depend on surface water provide either no treatment or levels of treatment that do not reliably protect against the microbiological pathogens that may be present in source waters. It is important to keep in mind that while these systems may be numerous, they serve a relatively small proportion of the province's population.

Disinfecting public surface water supply systems is a public health requirement under the *Drinking Water Protection Act* (DWPA). While some BC communities have a history of opposing disinfection with chlorine, one of the most cost-effective treatment processes available, they have the option of using other primary disinfectants such as ozone or ultraviolet (UV) light to treat their drinking water. People relying on systems known to not provide any treatment have been notified of the situation and have been told to either boil their water before consumption or to use an alternative source of drinking water. In addition, drinking water officers have instructed the owners of these systems to install proper treatment. In some cases, people supplied by these small systems have been united in their opposition to treatment and collectively oppose the direction of their drinking water officer.

For more information on boil water advisories, including the Provincial Health Officer's advisory for people with compromised immune systems, see Chapter 1. For more information about water supplies around the province, including the different sizes of systems in each region and the number of boil water advisories, see Appendix A.

5.1.2 Maintenance and Operation of Distribution Systems

While larger public water supply systems tend to do a good job of operating and maintaining their distribution systems, maintenance and replacement is sometimes inadequate in BC. Some systems are upgraded or repaired as failures occur

Unusual Backflow Incidents

A hose left in a body of water can suck contaminants into a water main if there is a drop in pressure and no device to prevent flow reversal. Some examples of documented backflow events in North America include:

- A hose left in a sink in a hospital morgue in Michigan sucked blood into a nearby drinking fountain.
- A valve was left open after employees rinsed a winery vat with water in Ohio. When the vat was refilled, the pressure in the tank was greater than the pressure in the city's water system, causing back pressure which resulted in wine flowing out of nearby household taps.

Source: *Summary of Backflow Incidents*. American Water Works Association, Pacific Northwest Section, 1995.

Deliberate Cross-Connection to Save Sun Peaks in 2003

Most water operators try to avoid cross-connections in their public water supply systems at all costs, but when forest fires threatened the Sun Peaks ski resort in 2003, utilities manager Pat Miller was faced with a tough choice to deliberately introduce non-potable water from the snow-making pond into the drinking water system.

"The firefighters told me they needed more water and they needed to use the hydrants. It was one of the most difficult decisions of my life," recalled Miller, who is the certified operator of the water system. "But it was either run the pond water through the system or potentially lose the resort. Trees were candling 4 kilometres away."

The resort was spared, but was on a boil water advisory for almost three weeks. It took 2½ weeks to flush and clean the mains, with water at 10 times the usual chlorine concentration, to return the system to potability.

rather than following a regular maintenance and replacement schedule for components. This problem is compounded and perpetuated by the fact that few systems are run with full-cost accounting and therefore budgets often do not accommodate proactive maintenance programs and system upgrades. For more information on full-cost accounting, see Chapter 8.

A number of challenges face water suppliers in the management and operation of their distribution systems. These include:

- Aging Infrastructure: Some pipes and fittings in BC's public water supply systems are many decades old. In fact, aging wooden storage reservoirs still exist on some systems. Old infrastructure can leak or break, creating pressure drops in the system that can cause the backflow of contaminants into the water or cross-connections with non-potable water. In future years, upgrading and replacing aging infrastructure will become an increasing challenge. In some cases, particularly in good neighbour systems that have grown without blueprints or engineering plans, the location of pipes is no longer known.
- Maintenance and Repair: Distribution systems and infrastructure must be regularly maintained. In some systems, regular flushing and cleaning of water mains must be done to prevent build-up of sediments and biofilm. Leaks and broken pipes must be promptly repaired to avoid situations in which treated potable water can be exposed to non-potable water (or even sewage). Water treatment equipment, such as chlorinators and ultraviolet light tubes must be maintained. In BC, inspections routinely identify evidence of poor maintenance and repair of infrastructure, particularly in small systems.
- Cross-Connection and Backflow Prevention: A cross-connection is a physical connection between any potable water supply with another water supply of unknown or poor quality where potable water could become contaminated or polluted. Pressure changes can cause water to reverse flow and introduce contaminants into the potable water system through either back siphonage or back pressure. Preventing cross-connections is essential to maintaining the integrity of the system. An effective cross-connection control program includes risk assessment, installation of backflow prevention devices, regular inspection, testing and maintenance of those devices and comprehensive inventory and management of the system.

5.1.3 Operator Training and Certification

The individuals who run BC's public water supply systems must have a good understanding of water quality, the competence to maintain the water system and the skills to protect water from contamination. Operators need to know how to supply safe water on a day-to-day basis and also how to respond to sudden instances of contamination, power outages, water main breaks, equipment failure and other operational upsets and emergency situations.

Courses covering various aspects and levels of water treatment, water distribution, chlorine handling, wastewater

management and other water system functions are available from a number of sources, including BC colleges, Thompson Rivers University, Simon Fraser University and correspondence courses with American institutions such as Sacramento State College. However, the biggest provider of water operation courses in the province is the British Columbia Water & Waste Association (BCWWA), a non-profit association of water and wastewater system professionals. One of the primary mandates of the organization is to provide training opportunities for people in the water and wastewater industries.

Operator training and certification at a level corresponding to the classification level of the water system is now mandatory under the *Drinking Water Protection Act*.[25] Water systems are classified by the Environmental Operators Certification Program (EOCP) according to their complexity (ranging from Class I, the least complex, to Class IV, the most complex). There is also a classification for small systems. Under the DWPA, any Class I or II public water supply system must be operated by a certified operator as of January 1, 2005. By January 1, 2006, certification requirements applied to Class III public water supply systems as well. Notwithstanding the above, a drinking water officer can place a condition on an operating permit specifying any compliance date for operator certification.

Recognizing that relatively few operators are certified to operate Class IV systems (three water treatment operators and five water distribution operators in 2003/2004) and that it will take considerably longer for an operator to obtain Level IV certification, no date has been specified in the Drinking Water Protection Regulation for the certification of operators of these systems. Certification dates for operators of these systems will be established as a condition on an operating permit in accordance with plans developed by water suppliers. The managers of some larger water distribution systems that are classified as Class IV systems have questioned the need to have operations overseen by a Level IV operator. These systems generally have extensive expertise available from professional staff within their water department, such as engineers, technicians and technologists, who do not qualify for operator certification, but who may be able to oversee distribution system operation.

As with facility classification, operator certification is conducted by the EOCP. This non-profit organization adheres to the principles of the North American Association of Boards of Certification (ABC). These principles are used in the certification programs of all provinces and territories (with the exception of Quebec) and 43 US states. This system has standardized certification criteria, including testing methods. It also allows credits to be transferred between jurisdictions.

Certification can be obtained at five levels (Classes I through IV and Small Systems), corresponding to the complexity of the system the operator will be running. Exams cover one or more of four basic categories or processes: water treatment, water distribution, wastewater collection and wastewater treatment.

The criteria to write a Level I exam is high school graduation plus one year hands-on work experience in a facility of the appropriate classification. For an operator to advance through the certification levels, s/he needs to meet increasingly stringent eligibility requirements, including post-secondary education and substantial experience at senior levels of operation. For instance, the criteria for writing a Level IV water treatment exam is a high school diploma (or equivalent), 1,800 hours of instruction (or equivalent) in the water field, 4 years of experience operating a Class III or higher facility, 2 years of direct responsible charge at such a facility and a Level III certificate.

Most municipalities made EOCP certification an integral part of their hiring and promotion policy within their organization well before it became mandatory under the DWPA. However, a common misunderstanding about certification is the belief that all staff of a public water supply system must be certified to the level at which the system is classified. For larger systems which need full-time qualified staff to operate, the EOCP system accommodates a range of qualifications for staff. Some staff are required to be certified to the level of classification of the system, but others can have lower certification levels or even certification as an "operator in training."

As mentioned, in addition to the mandatory requirement for certified operators, larger, more complex public water supply systems cannot be properly managed without additional

[25] *In December 2005, certification requirement dates were amended for Class I, II and III operators (to January 2006).*

professional expertise. The team of people required to manage a public water supply system may include engineers, technologists, technicians and microbiologists. Source protection measures may also require the expertise of professional foresters, engineers, hydrologists, agronomists and biologists.

5.2 Accountability

Figure 14 shows how the accountability framework discussed in the introduction applies to principle 5 of the Action Plan for Safe Drinking Water in British Columbia: "proper treatment and water distribution system integrity are important to protect public health." Progress and accomplishments related to each component are discussed in Section 5.3.

5.3 Progress and Accomplishments 2003/2004 and 2004/2005

5.3.1 Effective Strategies

To address issues related to water treatment and distribution system integrity, a number of strategies are in place. These strategies include provisions in Part 2 of the *Drinking Water Protection Act* that describe the requirements for issuing construction and operating permits for water supply systems and the qualification standards for people operating those systems. In addition, five sections of the Drinking Water Protection Regulation deal with water treatment, construction and operating permits, water monitoring analyses, reporting and public notification.

Construction and Operating Permits for Treatment Plants and Distribution Systems

Section 7 of the *Drinking Water Protection Act* and Section 6 of the Drinking Water Protection Regulation outline the requirements for water suppliers to obtain construction permits before constructing, installing, altering or extending a water supply system or its components. This provision allows drinking water officers to ensure that the proposed work will be conducted in accordance with appropriate standards and best practices using suitable materials. Where a permit is sought for the construction of a new water supply system, the approval process can ensure that it will meet all modern construction requirements at the point when it is commissioned and will have appropriate administrative processes in place. Where an applicant is improving an existing system, the permitting process can ensure that the supplier is addressing priority public health concerns. For example, applications to expand a water supply system may be rejected where treatment is inadequate and should be improved by the owner as a priority.

In addition to construction permits, operating permits are required (Section 8 of the *Drinking Water Protection Act* and Section 7 of the Drinking Water Protection Regulation). Water suppliers are also required to comply with all terms and conditions of the permit. The requirement for operating permits allows drinking water officers to ensure that a person is identified as being responsible for the ongoing operation of the system and to assess all operational needs of the system. Where improvements to the system are needed, the drinking water officer can attach appropriate conditions to the permit. Conditions on an operating permit can address any identified concerns that the issuing official believes pose a threat to the water supply system. Conditions may include time frames for staff to meet certification requirements applicable to a particular class of system; requiring capacity to operate the system on an ongoing basis without significant threat of failure or contamination of water in the system; expectations about treatment standards; monitoring and reporting requirements; and cross-connection control procedures.

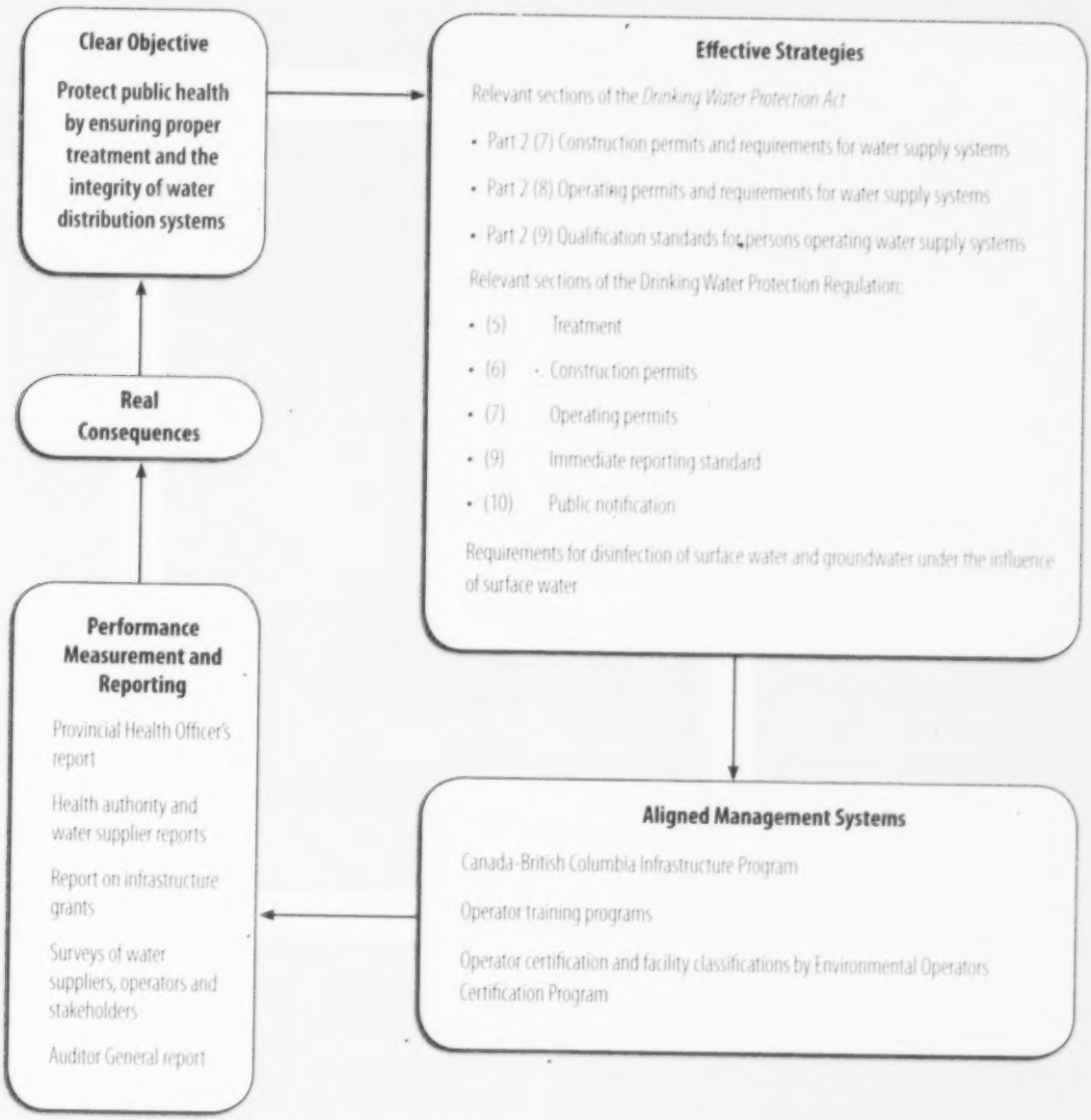
Water System Operation Activities

Good infrastructure will only provide good water if it is properly operated, maintained and repaired. Even the best filtration plant will fail to provide safe water if it is not properly operated by staff trained and experienced in its operation. Likewise, if control valves are not properly maintained, they will eventually seize up. Worse yet, improper operation of valves can create pressure regimes in a distribution system that can damage water mains. For this reason, one of the most important ways to ensure proper treatment and distribution system integrity is to ensure that the people operating, maintaining and repairing water systems are properly qualified.

The most significant new requirement imposed on water suppliers under the *Drinking Water Protection Act* is mandatory certification of public water supply system operators. Training and certification are two separate activities

Figure 14

Principle 5: Proper treatment and water distribution system integrity are important to protect public health


Clear Objective
Protect public health by ensuring proper treatment and the integrity of water distribution systems
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 2 (7) Construction permits and requirements for water supply systems
• Part 2 (8) Operating permits and requirements for water supply systems
• Part 2 (9) Qualification standards for persons operating water supply systems
Relevant sections of the Drinking Water Protection Regulation:
• (5) Treatment
• (6) Construction permits
• (7) Operating permits
• (9) Immediate reporting standard
• (10) Public notification
Requirements for disinfection of surface water and groundwater under the influence of surface water
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Health authority and water supplier reports
Report on infrastructure grants
Surveys of water suppliers, operators and stakeholders
Auditor General report
Aligned Management Systems
Canada-British Columbia Infrastructure Program
Operator training programs
Operator certification and facility classifications by Environmental Operators Certification Program

in BC, as they are in most jurisdictions in North America. That separation is important to ensure that water operators are not merely able to pass an exam based on a specific training course, but can demonstrate the knowledge and experience needed to operate the level of public water supply system on which they are employed.

5.3.2 Aligned Management Systems

The provincial government, health authorities and water suppliers have programs in place to align their management systems to support the proper treatment of public water supply systems and to ensure distribution system integrity. Inspections undertaken by drinking water officers and assessments conducted by water suppliers identify treatment and other infrastructure needs. Funding available through federal-provincial infrastructure grant programs are allocated to projects that benefit public health as a priority over other applications.

Where water suppliers have fiscal accountability to government, such as local government improvement districts and private utilities, priority is again placed on improvements to the system that will strengthen public health protection. All health authorities are developing programs to move water suppliers forward on a program of progressive improvements to treatment and distribution system integrity over time. These improvements include adopting, or encouraging water suppliers to adopt, the 4-3-2-1 treatment objective; incorporating treatment standards as conditions on operating permits; and using hazard rating and source-to-tap screening tools to assess water supplies and develop risk management plans.

4-3-2-1 Treatment Objective

A common goal for water treatment across Canada is to achieve **4** log (99.99 per cent) removal or inactivation of viruses and **3** log (99.9 per cent) removal or inactivation of *Giardia* and *Cryptosporidium* cysts using **2** types of water treatment (e.g. filtration and disinfection) and producing treated water with a turbidity level less than **1** NTU.

Operator training and certification programs are also key to ensuring proper treatment of drinking water and distribution system integrity.

Training

The BCWWA has been holding two- and five-day training courses on a wide variety of water and wastewater system issues for thirty years. In 2003, the association held more than 50 training courses across BC in communities as large as Vancouver and as small as Smithers and Nelson. This represents an increase in courses offered for small systems. The courses included water treatment courses (Level I and Level II), water distribution, cross-connection control, chlorine handling and a new course created three years ago to specifically meet the needs of operators of small public water supply systems (see Section 7.3.1). While operators at large municipal systems have been accessing training and becoming certified for years, often with their employer's support or encouragement, it has been much more difficult for small water system operators to access training as they may work in isolation or even be volunteers.

In 2004, the BCWWA offered 79 courses to water and wastewater professionals that attracted 1,290 participants. In 2005, these numbers increased to 84 and 1,440, respectively.

Certification

The Environmental Operators Certification Program (EOCP) in BC has evolved from a program originally established in 1966. Since its founding, the program has undergone a number of changes related to growth within the industry and legislative requirements for operator certification, first within the wastewater industry and then within the drinking water industry when the *Drinking Water Protection Act* came into effect.

To respond to these changes, the EOCP had to expand its services to ensure timely classification of water treatment and distribution systems, certification of operators, as well as management of data related to facilities and operators. To ensure the EOCP was able to improve capacity to meet the needs imposed by the DWPA, the Ministry of Health provided the program with funding for capacity development. In 2004/2005, the EOCP received $386,000. The EOCP has developed a business plan to support its capacity development and continues to modify its program

to improve efficiencies, develop greater capacity, improve data management to support drinking water officer oversight of certification requirements, accommodate rural and small water supply systems and improve transparency in their operations.

First Nations Water Systems

Band operators have access to training and certification. They can also participate in a "Circuit Rider" program in which an experienced operator comes to the community and works with the local operator to train him or her on the proper operation and maintenance of the band's water supply system.

During 2003/2004 and 2004/2005, Indian and Northern Affairs Canada and First Nations communities focused on improving and upgrading water supply systems in ways identified by the assessments. A major advance in this area has been the increase in the number of certified operators working for bands. Prior to 2003, 86 certified operators worked for First Nations water supply systems in the province. In 2003/2004, an additional 42 people obtained certification. In 2004/2005, another 18 became certified.

Table 7: Total number of classified facilities as of September each year

Water Treatment	2002	2003	2004
Class IV	5	6	7
Class III	10	10	15
Class II	22	25	29
Class I	5	5	5
Total	**42**	**46**	**56**
Water Distribution			
Class IV	24	28	33
Class III	20	21	34
Class II	43	56	82
Class I	80	81	82
Small Water Systems	25	50	134
Total	**192**	**238**	**365**

Facility Classifications

As mentioned in Section 5.1.3, the EOCP evaluates the relative complexity of the facilities in which operators work and assigns the treatment plant and distribution system a classification ranging from Class I (least complex) to Class IV (most complex). The classification process requires water system owners or operators to fill out an application form and send in a small ($50) fee to the EOCP. Most small public water supply systems (serving fewer than 500 persons), and a few larger ones, have not yet completed this procedure. Of the 3,957 public water supply systems in the province, 56 treatment systems and 365 distribution systems were classified as of September 2004 (see Table 7). This means more than 3,000 public water supply systems in the province have yet to be formally classified. However, the majority of these unclassified systems are small water supply systems, defined by the EOCP as serving a maximum of 500 people and which have a treatment component classified as Class I or Class II. The EOCP's general policy is to assume that all unclassified systems are small systems. In most such cases, operator qualifications are appropriate for a small system classification. It should also be noted that where a water supply treats only with chlorination or chloramination, it is not regarded as having a treatment plant. Consequently, the 56 treatment plants classified do represent the majority of treatment plants that actually exist.

Continuing Education

In February 2004, it was decided by the EOCP and the Ministry of Health that all certified operators would be required to meet a minimum level of mandatory continuing education in each two-year period in order to maintain their certified operator status. This requirement will mean operators of small public water supply systems will have to take 12 hours of continuing education every 2 years in order to hold a valid certificate. Operators certified at Levels I through IV will be required to take 24 hours of continuing education every 2 years to remain certified. This requirement is consistent with most other North American jurisdictions and will ensure that BC's water professionals are keeping up-to-date with the knowledge they need to provide safe drinking water. In order to transition to this new requirement, the first two-year period has been extended to three years for all operators.

Resources

The resources outlined in Section 4.1 apply to the construction, maintenance and repair of treatment and distribution systems. These resources include planning grants that enable water suppliers to identify their infrastructure needs and to develop strategies to achieve them, as well as construction approval processes that ensure water suppliers address infrastructure needs on a priority basis.

Infrastructure Improvements

Between 2000 and 2004, the Canada-British Columbia Infrastructure Program spent $606 million to fund more than 150 projects to improve water quality, water distribution systems and wastewater management. Under this program, each of the federal, provincial and local governments covered one-third of the project costs. As a result, the water quality of dozens of communities in BC is now improving, or has already improved. Some communities have been able to come off boil water advisories for the first time in years. (See Appendix C.)

Infrastructure grants are being used to cover exposed reservoirs, extend distribution lines to outlying communities not on municipal public water supply systems, explore new groundwater sources, and put in place various forms of treatment, from chlorinators to ultraviolet radiation and membrane treatment plants.

In early 2005, the Ministry of Community Services announced a new BC Community Water Improvement Program to bridge a gap in federal/provincial funding. Under this program, the provincial government will contribute two-thirds of the project costs (to a total of $80 million) and local government will cover one-third. Additional program funding will be available from 2005 to 2010.

Planning grants from the Ministry of Community Services are also available to local governments or through local governments to other water suppliers. These grants are available for studies that will enable water suppliers to develop strategies to improve their water supply systems.

5.3.3 Performance Measurement and Reporting

Section 11 of the Drinking Water Protection Regulation requires water suppliers to make annual reports to the public about the results of drinking water quality monitoring. Data on how many suppliers have issued such reports are not available.

Infrastructure Improvements

Highlights of improved treatment:

- A $12 million ultraviolet radiation treatment facility in the Capital Regional District on southern Vancouver Island was built, and began operation in April 2004. This new plant inactivates *Giardia* and *Cryptosporidium* cysts and oocysts.
- A $75 million ultrafiltration plant was built in Kamloops. Construction began in April 2003 on the largest and most complex ultrafiltration plant in North America. It will remove turbidity, viruses, bacteria and parasites from the water. The plant was commissioned in December 2004 and officially opened on February 18, 2005. It will deal with the periods of high turbidity that impact the public water supply and that have historically necessitated temporary boil water advisories.
- A $10 million ultrafiltration and ultraviolet disinfection treatment system was built for Erickson, which has been on a boil water advisory since the early 1990s. The plant removes viruses, bacteria and protozoan parasites, requiring only trace amounts of chlorine to prevent biofilm build-up in the distribution system. The new treatment system has resulted in a major improvement in water quality for the 1,700 people of Erickson and the 5,000 people in nearby Creston.

A full listing of projects funded under the Canada-British Columbia Infrastructure Program is provided in Appendix C. All the projects were started by March 31, 2006.

Operator Certification

In the first few years of the *Drinking Water Protection Act*, the number of certified operators has increased. By September 2004, 2,156 certifications for treatment plant and distribution system operators had been issued, compared to 1,616 by September 2002 (see Table 8). In that time frame, the number of certified water treatment operators increased from 422 to almost 800. The number of certified water distribution system operators increased from about 1,200 to almost 1,400.

Table 8: Operator certifications as of September each year

Water Treatment	2002	2003	2004
Level IV	3	4	3
Level III	2	4	6
Level II	22	32	34
Level I	72	85	116
Total	**99**	**125**	**159**
Water Distribution			
Level IV	4	5	5
Level III	62	76	81
Level II	413	455	507
Level I	715	742	769
Small Water Systems	323	440	635
Total	**1517**	**1718**	**1997**

The number of uncertified water operators in the province continue to be a challenge to determine. The regional health authorities have counted 1,166 public water supply systems serving 15 or more connections each and 2,791 systems with 14 or fewer connections. With a total of 1,997 certified water distribution system operators, if each system were to have one certified distribution system operator, this would leave 1,960 public water supply systems, the majority of them small, without any certified operators (as of September 2004). As an illustration, the Interior Health Authority records show that in the summer of 2004, of 1,352 operators in the region, 1,017 operators had no certification (almost 700 of whom worked on water systems with fewer than 15 connections), 101 had a level of certification lower than needed for the classification of system they were working on, and 234 were certified to the appropriate level. Twenty-two of the 29 operators employed by the largest public water supply systems were among those certified.

In 2003-2004, the Ministry of Health commissioned a number of surveys to better understand the impact of the new legislation on operator training and certification as well as perceptions about the roles and responsibilities of the Ministry of Health, health authorities, BCWWA and the EOCP. Those surveyed included water treatment operators, facility managers, health authority staff and industry stakeholders. The surveys showed that operators are generally satisfied with the courses they have taken and with the certification process, though training could be improved for small water systems and for Level III and Level IV operators. Managers and supervisors are also generally satisfied with the training received by their staff.

In terms of the roles and responsibilities of the Ministry of Health and health authorities, those interviewed were generally satisfied with the direction taken by the ministry, though they noted a need for the ministry to improve communication and support. They also asked for more guidance to help them understand and apply the new legislation. They indicated that more needed to be done to define small water systems and to determine appropriate training and certification requirements for operators of those systems. Finally, they noted the need for formal training of the drinking water officers hired by the health authorities.

5.3.4 Gaps

Four primary gaps exist related to proper treatment and distribution system integrity.

The first is the lack of comprehensive information about the state of treatment plants and distribution systems. This information is needed in order to properly report in this area. This gap should be filled through system assessments and improved information management systems.

The second is the lack of adequate infrastructure, particularly drinking water treatment systems in mostly small communities that rely on surface water sources for their drinking water. While a comprehensive overview of the existing infrastructure in BC is unavailable, the information provided by drinking water officers clearly identifies the need for treatment upgrades as a priority. Infrastructure improvements currently underway will go a long way toward addressing this gap, and infrastructure grant funding available through federal/provincial programs over the next few years will continue to allow local governments to improve their treatment.

Public water supply systems not owned by a local government (municipality or regional district) do not qualify for assistance from federal/provincial funding programs and often face the most significant challenges to improving drinking water treatment. In many cases, these water systems are not able to access loans to fund infrastructure improvements and must secure funding for work prior to any improvements being made.

The final gap is the lack of qualified operators for many of the smallest systems. Available training provides adequate opportunities for most water suppliers, but for some, financial limitations pose difficulties, particularly small remote systems that need to cover travel costs in addition to the course fees. Many small systems have found that courses cover a great deal of information not relevant to their operation. Changes to course delivery, including the development of a small systems correspondence course, may alleviate this concern.

Another complication is that very small systems may require so little operation that the person running the system cannot qualify for certification because s/he does not meet the hands-on operating criteria.

5.4 Recommendations

12. Government should consider options to improve access to funding support for public water supply systems that are currently ineligible for federal/provincial infrastructure assistance.
    Lead: Ministry of Community Services.

6. Drinking Water Quality

6.1 Context

6.1.1 Guidelines, Standards and Testing

Over the last 40 years, Canada, like numerous jurisdictions around the world, has developed water quality guidelines that set out maximum acceptable concentrations (MACs) of microbiological, chemical and radiological substances found in drinking water supplies. In addition, aesthetic guidelines are set for parameters like taste, colour and odour that can affect whether the public would want to drink the water. An optimal range may be set for substances such as fluoride that are added to drinking water because of their demonstrated public health benefit. Operational guidelines are set for parameters such as temperature and pH that can affect the operation of treatment processes. The *Guidelines for Canadian Drinking Water Quality* are established by the Federal-Provincial-Territorial Committee on Drinking Water and published by Health Canada.

The *Guidelines for Canadian Drinking Water Quality* are based on the best available, published scientific evidence. They also incorporate a range of management decisions such as the cost to meet a given requirement, the ability of existing treatment methods to reduce the levels of a particular substance in water, the concentrations of a substance in water that can be detected by laboratories and determinations of what constitutes an "acceptable risk" to public health. All of these practical considerations can affect the level at which a guideline is set.

The concept of "acceptable risk" is necessary because it is not possible to completely eliminate the presence of all pathogens or chemicals from drinking water. For some substances it is believed that there is a level below which adverse effects will not occur. For other substances, it is assumed but not necessarily proven that there is some probability of harm at any level of exposure and guidelines are set to achieve an acceptable risk. At present, the latter assumption is generally considered to be appropriate for some cancer-causing substances. MACs for many chemical substances are often calculated to incorporate significant margins of safety. Safety margins mean that guideline values are set well below the level at which any adverse health effects have been observed or are expected.

MACs are also set for microbiological parameters where possible. For instance, because of the potential severity of effects from exposure to very low doses of some fecal bacteria, the MACs for E. coli and coliforms are "none detectable per 100 mL." On the other hand, no MAC has been set for protozoa such as *Giardia* or *Cryptosporidium* because the routine detection methods for the cysts and oocysts are unable to provide accurate information about their numbers (low recovery rates), nor do they provide information about the ability of the cysts and oocysts to survive, develop normally or infect humans. In cases where no MAC is set, the guidelines strongly recommend water suppliers protect public health by following a multi-barrier approach to ensure the safety of their drinking water supply from source to tap.

6.1.2 Monitoring

Monitoring water quality is critical to ensure it meets acceptable criteria. Source water monitoring gives system owners and operators the information they need to determine the type of treatment required. Performance monitoring tells treatment plant operators about the performance

and effectiveness of their chosen treatment processes. Distribution system monitoring helps detect water main breaks, leaks and regrowth of bacteria in pipes before these become significant problems. In addition, monitoring the levels of disinfectant in the distribution system indicates whether the water reaching consumers is safe to drink.

Monitoring programs and reporting have tended to focus on microbiological samples collected from treatment plants and distribution systems. Microbiological monitoring is critical for evaluating water quality but is only one component of a comprehensive monitoring program. Microbiological testing programs are only able to check a small amount of the water provided by a water supply system because samples are not collected from every location in a water distribution system, nor from every moment water is being used. Small systems (serving fewer than 500 people) are only required to collect four samples per month. Relying solely on these monitoring programs to ensure water quality means some people could be exposed to unsafe water for more than a week before a problem is found in small systems. The required frequency of microbiological testing in BC has been adopted directly from the *Guidelines for Canadian Drinking Water Quality* but can be modified by a drinking water officer as a condition on an operating permit if warranted by the results of an assessment of the water supply system. Larger systems collect samples more frequently. For example, the Greater Vancouver Regional District (GVRD) samples source and treated waters daily for bacteriological analysis. An additional 4,000 bacteriological samples are collected from GVRD transmission mains each year, with a further 15,000 samples per year being tested by the GVRD lab from distribution systems owned by other municipalities in the district. This count does not include samples from the City of Vancouver as it maintains a separate monitoring program. In addition to the bacteriological sampling, the GVRD tests its water on at least an annual basis for each chemical for which there is a national guideline. In-line testing equipment is used by the GVRD to monitor both water quality and treatment effectiveness.

In order to determine which other water quality parameters to monitor, each new public drinking water supply in BC is tested for an appropriate range of chemical contaminants to establish a baseline understanding of which chemicals are in the water and at what concentrations and then routinely tested for a subset of chemicals. The total list of parameters assessed varies with local experience. Thereafter, repeat screens for specific chemicals is left to the discretion of the drinking water officer who takes into account an assessment of the potential contamination of the individual water source and the potential risk of isolated chemical exposure. This flexible approach protects public health as it is based on the potential variability of chemical or microbiological contamination of each individual public water supply. This approach is also fiscally responsible as testing for all substances for which there is a guideline could cost in excess of $3,000 per system each time testing is undertaken. With almost 4,000 public water systems in BC, one such extensive test would cost water suppliers close to $12 million. For example, having a legislated standard that forces a water system like the Capital Regional District on Vancouver Island to repeatedly test for arsenic—when there is neither a history of arsenic in the water nor arsenic-bearing rock in the watershed—is unnecessary. Instead, that effort and money can be used to screen and treat the contaminants that do pose a risk, most notably pathogens such as bacteria and protozoan parasites.[2]

Comprehensive monitoring programs also verify the effectiveness of treatment processes and distribution system integrity. These programs must be tailored to the specific water supply system to take into account the type of treatment used and the risks associated with the distribution system. Suppliers may need to monitor turbidity, colour or particle counts in order to evaluate filtration performance, and chlorine residuals and flow rates to determine the effectiveness of the disinfection. Monitoring water flow and pressure in the distribution system can help identify leaks, which can be a potential source of contamination. Monitoring these variables brings many benefits to water quality assurance programs, including:

- **Real-time information:** tests for these variables provide instant information on water quality, allowing operators to take immediate action if problems are identified. Much of this information can be collected automatically and with great frequency, using technology that alerts the operator when a problem occurs.

[2] *An ultraviolet irradiation plant to treat water for protozoan parasites such as* Cryptosporidium *was officially opened in Victoria in April 2004.*

- **Cost-effectiveness:** testing equipment can be relatively inexpensive, giving operators access to important water quality data on a daily, hourly or continuous basis, depending on the needs of the system.
- **Treatment effectiveness monitoring:** protozoa, such as *Cryptosporidium* and *Giardia*, can survive treatment that kills *E. coli* and total coliform bacteria. Monitoring the effectiveness of treatment, such as filtration and ultraviolet irradiation, rather than relying solely on indicator bacteria, can provide assurance that the risk to consumers from these parasites is being properly managed and that early warning of treatment failure will be provided if it does occur. Treatment effectiveness monitoring can include testing chlorinated water for chlorine residual, evaluating filter performance by monitoring turbidity levels or measuring the transmissivity of water to ultraviolet irradiation where it is being used to treat water.

6.2 Accountability

Figure 15 shows how the accountability framework discussed in the introduction applies to principle 6 of the Action Plan for Safe Drinking Water in British Columbia: "Tap water must meet acceptable safety standards and be monitored." Progress and accomplishments related to each component are discussed in Section 6.3.

6.3 Progress and Accomplishments 2003/2004 and 2004/2005

6.3.1 Effective Strategies

A number of strategies are in place to make sure drinking water meets acceptable safety standards and is monitored. These strategies include provisions in Part 2 of the DWPA that set out the water monitoring requirements that suppliers must follow and the steps they must take to notify public health officials and consumers in the event that monitoring results show that drinking water fails to meet the requirements and/or may pose a threat to health. Section 2 of the Drinking Water Protection Regulation sets out the standards that potable water must meet and Section 8 describes how the water must be monitored. In addition, government has established sampling policies for water suppliers and drinking water officers. It has also established policies for attaching terms and conditions related to water quality monitoring on operating permits. The Provincial Health Officer is responsible for approving laboratories that test water samples for microbiological contaminants. For more information, see Section 1.3.3.

Schedules A and B of the Drinking Water Protection Regulation

Schedule A of the Drinking Water Protection Regulation sets out the water quality standards for potable water that all public drinking water systems in the province must achieve. Schedule B outlines the monitoring frequency for these systems. In 2003/2004, health authorities collected data on their public water supply systems, including the number of systems that are not yet compliant with Schedule A. The data collected shows that in 2003/2004, 368 of the 3,957 public water supply systems in the province, or slightly less than 10 per cent, were non-compliant in this time period. The majority of these systems (234) were very small, with fewer than 15 connections. A further 128 of the non-compliant systems served between 15 and 300 connections. A breakdown of the systems by size and region is given in Appendix A.

The requirement to provide potable water under the DWPA gives drinking water officers the ability to evaluate a wide range of physical and chemical variables. The monitoring regime for any one public water supply system will be based on the specific concerns for that system.

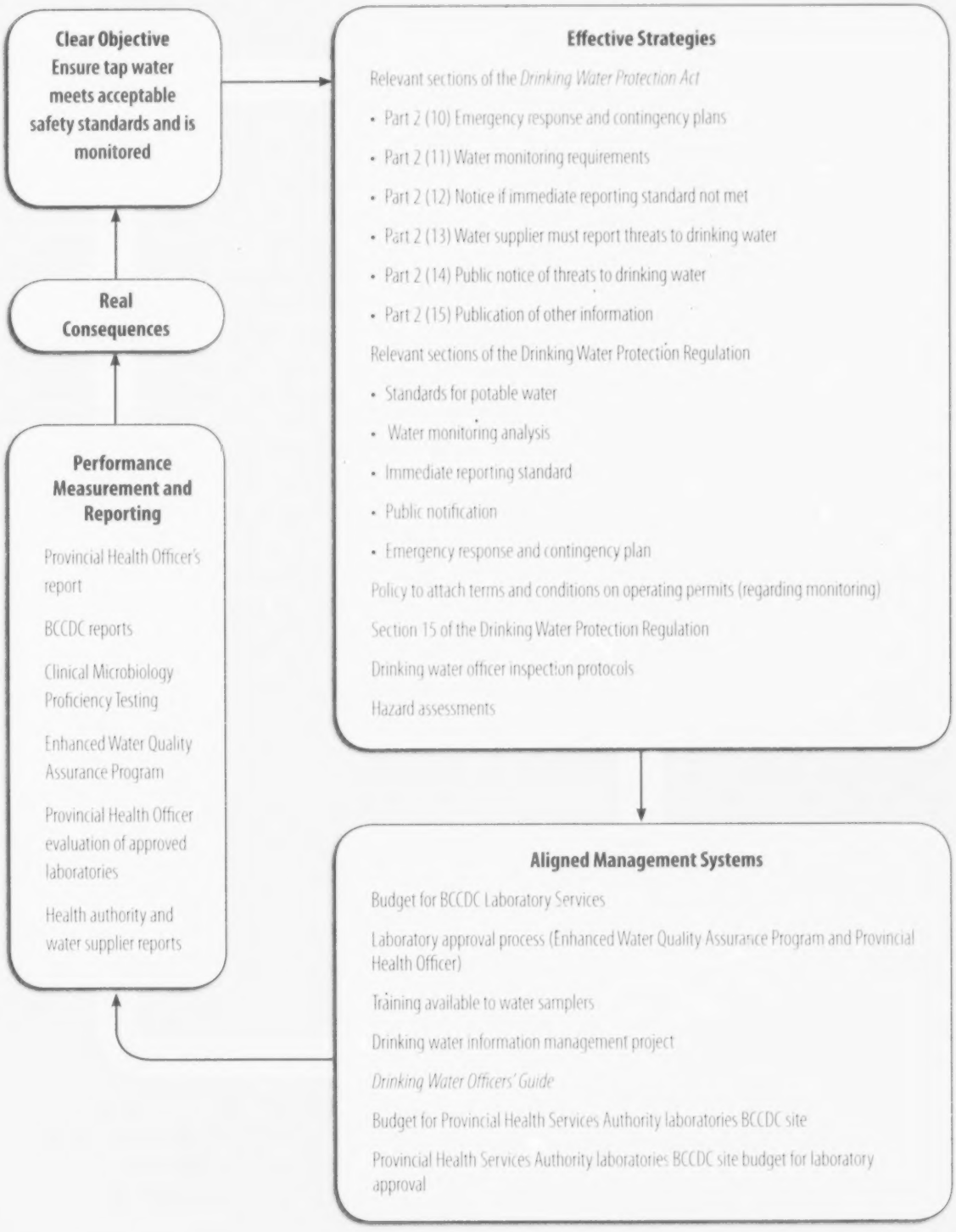
The *Guidelines for Canadian Drinking Water Quality* form the basis for evaluating water chemistry and treatment performance.

6.3.2 Aligned Management Systems

Provincial Health Officer Approval of Laboratories

As of March 2004, the Provincial Health Officer had approved 15 laboratories to conduct microbiological testing of water samples from public water supply systems around the province. This list remained unchanged as of March 31, 2005. The list of approved laboratories is given in Figure 16. For a

Figure 15 **Principle 6: Tap water must meet acceptable safety standards and be monitored**


Clear Objective
Ensure tap water meets acceptable safety standards and is monitored
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
BCCDC reports
Clinical Microbiology Proficiency Testing
Enhanced Water Quality Assurance Program
Provincial Health Officer evaluation of approved laboratories
Health authority and water supplier reports
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 2 (10) Emergency response and contingency plans
• Part 2 (11) Water monitoring requirements
• Part 2 (12) Notice if immediate reporting standard not met
• Part 2 (13) Water supplier must report threats to drinking water
• Part 2 (14) Public notice of threats to drinking water
• Part 2 (15) Publication of other information
Relevant sections of the Drinking Water Protection Regulation
• Standards for potable water
• Water monitoring analysis
• Immediate reporting standard
• Public notification
• Emergency response and contingency plan
Policy to attach terms and conditions on operating permits (regarding monitoring)
Section 15 of the Drinking Water Protection Regulation
Drinking water officer inspection protocols
Hazard assessments
Aligned Management Systems
Budget for BCCDC Laboratory Services
Laboratory approval process (Enhanced Water Quality Assurance Program and Provincial Health Officer)
Training available to water samplers
Drinking water information management project
Drinking Water Officers' Guide
Budget for Provincial Health Services Authority laboratories BCCDC site
Provincial Health Services Authority laboratories BCCDC site budget for laboratory approval

current list of approved labs see http://www.pathology.ubc.ca/education/__shared/assets/PHO_Approved_Laboratory_List934.PDF

Policy Manual for Drinking Water Officers

In 2003/2004, a draft policy manual, entitled *Drinking Water Officers' Guide*, was developed for drinking water officers. It includes guidance on attaching terms and conditions to operating permits. These terms and conditions may include requirements for online monitoring of turbidity and chlorine residuals. These requirements are being phased in, with the larger systems needing to meet the requirements first. A working draft of the policy manual was available in 2004/2005 and can be found online at http://www.health.gov.bc.ca/protect/dwoguide.pdf.

Water Sampling Training and Instructions

In 2003/2004, the BCWWA expanded its courses for operators to include training on proper sampling techniques. Sampling instructions are also available from the laboratories. These courses continued to be offered in 2004/2005. In addition, a new distance education program for water purveyors was under development during the reporting period as a collaborative project between BCCDC Laboratory Services, BCWWA and Simon Fraser University.

Drinking Water Information Management Project

As noted earlier in the report, government has launched a drinking water information management project. This project is a cross-government initiative, led by the Ministry of Health,[5] to understand and standardize the way in which the many agencies and stakeholders that impact BC's water resources use common information to manage the province's public water supply systems.

6.3.3 Performance Measurement and Reporting

The performance of the provincial government, health authorities and water suppliers in following through to make sure drinking water is monitored and meets acceptable safety

Figure 16 **Laboratories approved by the Provincial Health Officer for water microbiology testing (2003/2004 and 2004/2005)**

Lower Mainland

ALS Environmental, Vancouver (Total Coliform, Fecal Coliform)

BCCDC Environmental Microbiology Laboratory, Vancouver (Total Coliform, Fecal Coliform, *E. coli*)

GVRD Water Laboratory, Vancouver (Total Coliform, Fecal Coliform, *E. coli*)

IG Micromed Environmental Inc., Richmond (Total Coliform, Fecal Coliform, *E. coli*)

Cantest Ltd., Burnaby (Total Coliform, Fecal Coliform, *E. coli*)

Norwest Labs, Surrey (Total Coliform, *E. coli* by enzyme substrate method)

PSC Analytical Services Inc., Burnaby (Total Coliform, *E. coli* by enzyme substrate method)

Vancouver Island

CRD Water Laboratory, Victoria (Total Coliform, Fecal Coliform, *E. coli*)

JB Laboratories Ltd., Victoria (Total Coliform, Fecal Coliform, *E. coli*)

MB Laboratories Ltd., Sidney (Total Coliform, Fecal Coliform, *E. coli* by enzyme substrate method)

North Island Laboratories, Courtenay (Total Coliform, Fecal Coliform, E. coli)

BC Interior

Caro Environmental Services, Kelowna (Total Coliform, Fecal Coliform, *E. coli*)

Mid-Coast

Northern Laboratories Ltd., Prince Rupert (Total Coliform, Fecal Coliform, *E. coli*)

Alberta

Provincial Laboratory For Public Health (Microbiology), Calgary (Total Coliform, Fecal Coliform, *E. coli*)

Provincial Laboratory For Public Health (Microbiology), Edmonton (Total Coliform, Fecal Coliform, *E. coli*)

[5] *In 2006 leadership for this project was transferred to the Ministry of Environment.*

standards is measured and reported through reports from the BCCDC, the evaluations of laboratories by the Provincial Health Officer, reports from health authorities and individual water suppliers and the report from the Provincial Health Officer on activities that have taken place under the authority of the DWPA. As noted in earlier sections, these reports will be reviewed by government officials and made public.

Laboratory Activities to Measure Water Quality

During the 2003 calendar year, more than $900,000 was spent on testing drinking water samples in BC for bacteria (indicators of fecal contamination), either through the BCCDC laboratory or through Provincial Health Officer approved laboratories under contract to the BCCDC. During this time, 75,715 water samples were tested, of which 23 per cent were conducted at contracted laboratories. This number represents an increase of more than 20,000 samples compared to 1998. These test volumes only include those conducted by approved laboratories under contract with BCCDC. Thousand of additional samples are tested at the expense of water suppliers. The GVRD and CRD maintain their own approved laboratories. The number of approved laboratories has increased from 10 to 15 over the same period. Two recently approved laboratories are in Alberta and may be able to handle samples from the eastern edge of BC. Three more laboratories are under review for approval. For a full report of all the BCCDC work in 2003/2004, see Appendix B.

Reporting of Water Quality Conditions to the Public

Section 15 of the *Drinking Water Protection Act* requires drinking water suppliers to publicly report water quality monitoring results to their consumers on an annual basis. These reports are available directly from each water supplier. The health authorities also report on water quality conditions in their regions. The summary of their 2003/2004 reports provided in Appendix A includes information about water quality monitoring results. Ad hoc reports are made to the public in the form of system-specific notifications, either from the drinking water officer or the water supplier, when monitoring results indicate that water quality has been compromised.

Many public water supply systems maintain websites where they post regular updates on their water quality monitoring programs.

6.3.4 Gaps

The BC provincial government, health authorities and water suppliers are challenged in their ability to meet the objective of ensuring drinking water meets acceptable safety standards and is monitored, due to a number of gaps.

Many public water supply systems, particularly smaller systems, regularly fail to meet basic standards for bacteriological water quality. Frequently, some supplies relying on unfiltered surface water sources experience high levels of turbidity, resulting in aesthetically unpleasant water and potentially compromised treatment effectiveness. Unfortunately, bacterial monitoring is not a reliable method of determining whether or not protozoan pathogens such as *Giardia* or *Cryptosporidium* pose a public health risk. These organisms can survive disinfection that kills bacteriological indicator organisms.

To ensure that protozoa do not pose a threat to consumers, water that is at risk of containing them (such as surface water sources), should be treated using methods known to remove or inactivate them. The effectiveness of these treatment methods then needs to be monitored. Many water suppliers are not providing treatment capable of effectively reducing risks from protozoa.

Anecdotal reports from drinking water officers suggest that some water suppliers could improve their monitoring of treatment and distribution system integrity.

Laboratories approved for bacteriological testing of water samples are located in the Lower Mainland, Vancouver Island, Prince Rupert and Kelowna. Some water suppliers in remote areas are unable to reliably transport all of their water samples to these locations rapidly enough (within 30 hours of collection) to be tested. Transportation of samples is particularly challenging for water suppliers located in the East Kootenays and in remote northern communities. The difficulty in shipping can be compounded by water samples actually freezing during shipping delays in the winter, making them unsuitable for analysis.

While effective processes are in place to ensure that drinking water officers and water suppliers receive timely notification of bacteria testing results, the subsequent data management

systems do not yet fully support public reporting at a provincial level. Water chemistry data are even more difficult to access at this level.

6.4 Recommendations

13. Based on the needs identified by assessments and the requirements stipulated on operating permits, water suppliers should implement or expand treatment performance monitoring to include variables such as CT,[28] filtration performance, turbidity, UV performance, pH and pressure regimes as appropriate.
Leads: Water suppliers, drinking water officers.

14. To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged.
Leads: BCCDC and the EWQA Program.

[28] *CT is a measure of disinfectant concentration and time that the disinfectant is in contact with treated water prior to reaching the first consumer. Tables have been developed that establish the appropriate CT to achieve pathogen reduction under various conditions of temperature and pH.*

7. Small Systems

7.1 Context

The operators of very small public water supply systems face difficulties in accessing appropriate training, funding system upgrades and monitoring water quality in accordance with the microbiological schedules of the Drinking Water Protection Regulation.

Small systems pose problems for data collection, regulation and control. The term "small system" is applied to a wide range of types of drinking water supplies. A small system can have one connection to a household, restaurant or gas station. It could connect a cluster of trailer homes or service a campground. A few communities have water brought in by trucks.

Some small systems have no easily identified owner or operator. These systems develop in a number of ways, for instance:

- When a number of homes tap into a single well.
- When the legal owner dies.
- When a company is dissolved.

Small systems can also develop on an ad hoc basis as neighbours connect private supplies together or when small systems merge. Historically, these actions have taken place with no regulatory oversight. Currently, systems with as many as 300 users exist that are poorly constructed, lack adequate treatment and face many challenges in meeting regulatory requirements.

In many cases, legal easements grant neighbours access to wells. There is debate as to whether the water is supplied by the one neighbour or taken by the other—a detail that could influence legal obligations. Some of these systems are connected to 20 or more households and may or may not be properly monitored or maintained. In many cases, no plans, drawings or records exist, meaning there is no way to know where these small systems are located and whom they serve.

Training and Certification

Even though the Environmental Operators Certification Program (EOCP) had certified 635 operators at the "Small System" level by September 2004, training and certification of operators of small public water supply systems is a challenge. Some may only be volunteers or lack the time and resources to attend training. Very small systems may require so little operation that the person running the system cannot get the 50 hours of hands-on experience over a 6-month period to qualify for certification. These owners have little hands-on experience in operating a system; rather, they manage the system but call in technical support if there is a problem, either on an ad hoc basis or through a regular service agreement.

Some owners of small systems and health authority staff have shown a great deal of concern about operator certification. These concerns relate to who needs to be certified, the difficulties in obtaining certification and a lack of knowledge of how to obtain certification. For instance, remote locations, limited budgets and a lack of personnel to cover for them can prevent small water system operators from attending a training course and/or taking a subsequent exam.[1]

[1] The Drinking Water Protection Regulation was amended in December 2005 to allow drinking water officers to specify training requirements or certification for small system operators as a condition on operating permits.

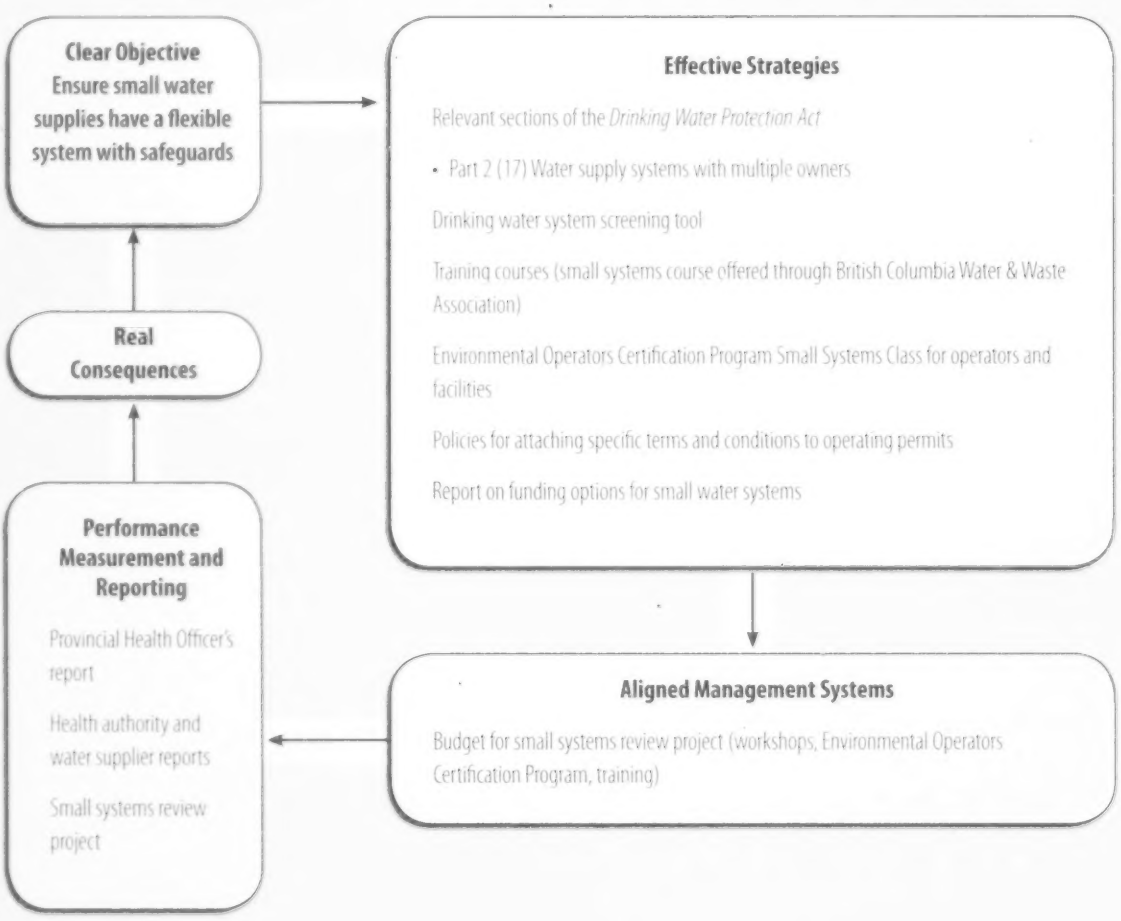
For slightly larger systems, Indian and Northern Affairs Canada's "Circuit Rider" program could provide a model for training. This program funds experienced and certified water professionals to travel to First Nations reserves to provide on-site training in the operation and maintenance of water and sewage facilities. This model could help operators in charge of small public water supply systems in remote locations that have difficulty attending training or obtaining certification under existing programs.

Water Quality

As noted earlier, a significant number of BC's small public water supply systems relying on surface water sources provide levels of treatment that do not reliably protect against parasites that may be present in source waters. Some provide no treatment at all. Indeed, some communities have a history of opposing disinfection with chlorine, one of the most cost-effective disinfectants available.

The majority of boil water advisories in the province are placed on these smaller systems. In 2003/2004 and 2004/2005, most of the long-term advisories were on public water supply systems with 1 to 300 connections serving an estimated 1 per cent of the total BC population. For more information on boil water advisories, see Section 1.1.2.

Figure 17 **Principle 7: Small systems require a flexible system with safeguards**


Clear Objective
Ensure small water supplies have a flexible system with safeguards
Effective Strategies
Relevant sections of the Drinking Water Protection Act
• Part 2 (17) Water supply systems with multiple owners
Drinking water system screening tool
Training courses (small systems course offered through British Columbia Water & Waste Association)
Environmental Operators Certification Program Small Systems Class for operators and facilities
Policies for attaching specific terms and conditions to operating permits
Report on funding options for small water systems
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Health authority and water supplier reports
Small systems review project
Aligned Management Systems
Budget for small systems review project (workshops, Environmental Operators Certification Program, training)

7.2 Accountability

Figure 17 shows how the accountability framework discussed in the introduction applies to principle 7 of the Action Plan for Safe Drinking Water in British Columbia: "small systems require a flexible system with safeguards." Progress and accomplishments related to each component are discussed in Section 7.3.

In addition to requirements under the *Drinking Water Protection Act* (DWPA) for public reporting and all the accountability measures that apply to all public water supply systems, many smaller public water supply systems are subject to other accountability frameworks. Water user communities, incorporated under the *Water Act*, are required to submit reports to the Ministry of Environment, and all households supplied by the community have both rights and responsibilities under the Act. Private water utilities and Improvement Districts are fiscally accountable to the Ministry of Environment and Ministry of Community Services respectively.

7.3 Progress and Accomplishments 2003/2004 and 2004/2005

7.3.1 Effective Strategies

A number of strategies are in place to make sure that the regulatory and management requirements for small public water supply systems are flexible, with safeguards in place to make sure public health remains protected. These strategies include provisions in Part 2 of the *Drinking Water Protection Act* that deal with water supply systems with multiple owners. Other strategies include policies for attaching specific terms and conditions to operating permits.

Small Systems Classification and Certification
The EOCP has developed criteria for classifying small water supply systems and certifying small system operators. In order to be considered a small water system, the system must serve fewer than 500 people and be classified as a Class I or Class II facility. Small systems operators must have at least 50 hours and 6 months of hands-on experience operating the facility or its equivalent as well as having completed appropriate training. These criteria were developed at the request of the Ministry of Health, but still fail to address the qualification of very small systems.

As of September 2003, 440 small systems operators were certified and 50 small water systems were classified. In 2004, these numbers increased to 635 and 134, respectively.

Drinking Water Source-to-Tap Screening Tool
This newly developed tool takes water suppliers through a step-by-step analysis of their system to flag deficiencies and concerns. It was primarily designed to help small public water supply systems conduct hazard assessments from source to tap. Published in 2004, it is being implemented by the Drinking Water Leadership Council. The screening tool is available online at http://www.health.gov.bc.ca/protect/pdf/BC_Drinking_Water_Screening_Tool.pdf.

Training Courses
The British Columbia Water & Waste Association (BCWWA) has been holding two and five-day training courses on a wide variety of water and wastewater system issues for thirty years. In 2003, the small water system course was offered 9 times and attracted a total of 199 registrants during the calendar year. This number includes 48 enrollees for a single course in Fort St. John in October 2003. In 2004, 628 operators registered for 38 courses. In 2005, the number dropped to 458 registrants for 29 courses. The decrease in courses and attendees in 2005 reflects both the fact that initial demand was high and declined as people finished taking the course and the fact that the very small system operators were anticipating a regulatory change to operator requirements and were waiting to see what those changes would be.[9]

In addition to the training courses offered by the BCWWA, a training program for people in charge of very small water supply systems with little operational complexity was being developed by Thompson Rivers University with funding from the Ministry of Health (completed in January 2006).

7.3.2 Aligned Management Systems

The provincial government, health authorities and water suppliers have started to align their management systems through a small systems review project. This project has included funding, resource development and training.

[9] *Regulatory change was made in December 2005.*

Small Water Systems Review Project

The focus of the Small Water Systems Review Project has been to examine the multitude of issues related to BC's numerous small public water supply systems and to find workable solutions. To launch the project, 18 individuals with small system knowledge and experience attended a day-long session in November 2003. They worked to identify both the current strengths of BC's small systems and the issues that needed to be addressed. A report of the proceedings was produced that demonstrated the many complexities of small public water supply systems.

A consultation process with small public water supply systems stakeholders was undertaken throughout the province in the winter of 2003 and spring of 2004. Sessions attracted a large number of participants, showing that small water system operators are eager for more information and solutions to their many challenges. The consultations resulted in a series of recommendations presented to government in late 2004. The recommendations included considerations for amending the definitions of small systems and single family residences, breaking down the small water systems facility classification into further categories, developing a policy for allowing small systems to classify themselves rather than having to use third-party processes and developing a "water safe" program for very small water systems similar to the "food safe" program for restaurants. These recommendations resulted in a number of regulatory changes made in December 2005.

In addition to regulatory changes, a number of other initiatives have been undertaken under the auspices of the Small Water Systems Review Project. These include:

1. A literature review undertaken early in 2004 to examine the material available worldwide on the operation of small water systems. Existing best practices were identified where available.
2. The identification of tools required by small water systems.
3. The drafting of a generic business plan for small systems.
4. The promotion of business planning through visits to small water suppliers in the Interior and Vancouver Island and presentations at conferences.
5. The development of a database of companies and other organizations providing services and technology for small and medium water suppliers.
6. The completion of a feasibility study outlining funding options for public water suppliers. (A report, *Funding for Water – A Preliminary Review of Selected Funding Options for Small Water Systems in British Columbia*, was completed in October 2004.)
7. The establishment of umbrella organizations to advance the interests of small water suppliers and provide a forum for water supply organizations and branches of government to discuss matters of mutual interest. In 2003/2004 and 2004/2005, proposals for the mandate, mechanisms for coordination between organizations and other issues were under active development.
8. The development of a small systems guidebook that emphasizes the public health perspective. Once complete this guidebook may be part of a Water Safe program with a province-wide reach. Part 1 of the guidebook, covering organizational issues, would form the basis for workshops targeted at the trustees and directors of small water systems throughout the province. For more information, see http://www.sustainis.org.

7.3.3 Performance Measurement and Reporting

Generally, performance measurement and reporting for small water systems is incorporated in the performance measurement and reporting covered in other sections of this report. The additional challenges unique to small systems are being addressed through the Small Water Systems Review Project. Reports or resources developed through that project will be available on the Ministry of Health website at http://www.health.gov.bc.ca/protect/dw_index.html or through partner organizations.

7.3.4 Gaps

Gaps outlined in other sections of this report all apply to some degree to small systems. That said, a number of issues are of particular concern to these systems. The Small Water Systems Review Project is identifying these gaps in existing strategies and management systems and will continue to develop solutions as required. Some of the major challenges faced by the owners of small water supply systems include a general lack of technical, managerial and financial capacity, difficulties accessing appropriate training, and operating systems with aging and often poorly constructed infrastructure. These challenges are currently being addressed by the Sustainable Infrastructure Society through funding provided by the Ministry of Health.

Privately Owned Water Supply Systems

Under the *Water Utility Act*, new privately owned water supply systems that serve, or will serve, five or more connections are required to be developed as a water utility. These systems are required to meet engineering and financial criteria not required under the *Drinking Water Protection Act* (i.e., they need to be designed to provide flow rates adequate for firefighting purposes). The Water Use Planning and Utilities section of the Ministry of Environment has been discouraging the creation of systems that serve fewer than 50 homes because of the financial difficulties these systems can experience. The *Water Utility Act*, however, has had the inadvertent effect of encouraging developers to create multiple systems that serve fewer than 5 connections each to avoid regulation. In some cases, subdivisions with well over 50 homes have been developed with many systems serving four homes each rather than one system serving the entire development. No legal authority currently exists to readily allow the province to prohibit the proliferation of these small private systems during the subdivision process.

7.4 Recommendations

15. Government should undertake to develop an accurate inventory of BC's small public drinking water supply systems and obtain all of the data identified as part of the drinking water information management project core data set.

    Leads: Health authorities, Ministry of Health.

16. Strategies should be developed to prevent the creation of new small water supply systems where other supplies could be expanded or existing supplies amalgamated. These strategies should include regulatory amendments that:

    a) Prohibit the creation of multiple small water supply systems where one larger system could be developed.

    b) Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.

    c) Provide authority to require developers to connect new properties with existing adjacent water supply systems.

    Lead: Ministry of Community Services.

8. Full-Cost Accounting

8.1 Context

Full-cost accounting involves projecting all costs for the life of the water system, including small parts that need annual replacement, or the repair and replacement of water mains, storage reservoirs or concrete structures that need attention at intervals of 20 to 100 years. In order to accommodate proactive monitoring and maintenance programs and system upgrades, public water supply systems need to ensure that financial capacity is included in their system assessments and assessment response plans. Financial capacity should take into account all sources of funding, including infrastructure grants and water rates paid by users. Water rates that consider all costs enable suppliers to operate proper maintenance programs; unrealistically low water rates can result in water system degradation and, potentially, risks to public health.

In many communities across BC, water rates do not adequately reflect the true costs of supplying water. Maintaining these low rates means water suppliers are often not training operators, making necessary upgrades to water treatment and distribution system components or conducting proper maintenance. When repairs or expansion are necessary, reserve funds are not available and suppliers are delayed in taking appropriate steps. While full-cost accounting is one mechanism available to water suppliers to help them ensure water users pay appropriate costs, it does not address all aspects of ensuring safe drinking water will be affordable.

8.2 Accountability

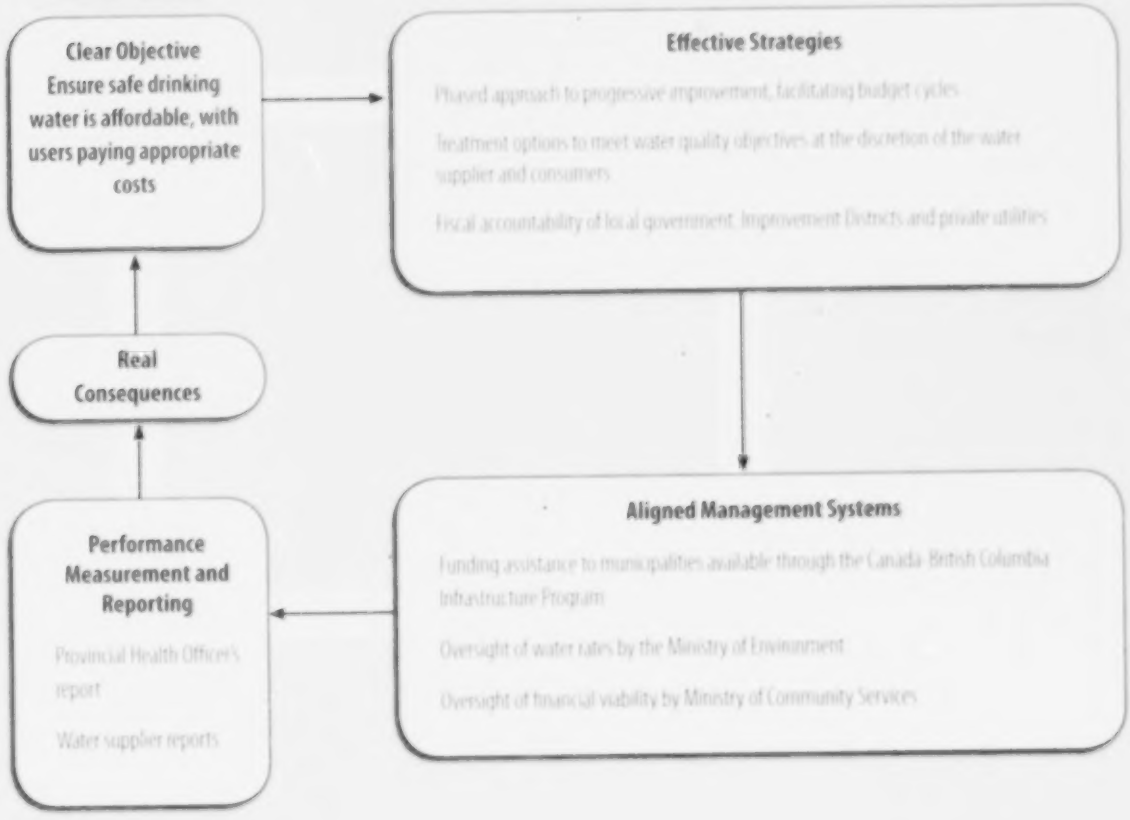
As previously discussed, public water supply systems owned by municipalities, regional districts and private utilities are fiscally accountable to the provincial government. This accountability provides varying levels of assurance that these water suppliers are managing budgets in a manner that ensures they are appropriately considering all water system needs over both the short- and long-term. Moreover, it is clearly in the best interests of the water supplier to ensure an adequate revenue stream. In the case of water supply systems under other ownership, accountability mechanisms do not exist.

In cases where small public water supply systems serve residential customers, but are not fiscally accountable to the government, they can still be held accountable by their customers. However, there is no legal mechanism to ensure this accountability. Where a water supply system is owned by and serves a commercial operation, such as a hotel or restaurant, it is unclear to whom the owner would be financially accountable.

Many water suppliers are budgeting for annual operation and maintenance, and not accumulating funds for periodic and high-cost maintenance or replacement costs such as replacing storage reservoirs or water mains. Even with an accountability framework in place, it is not possible to require water suppliers to plan for increased costs or raise their rates to accommodate infrastructure improvements. Since infrastructure improvements to local government water supply systems need to be approved by the affected residents, it is possible for these residents to reject both the infrastructure work and the associated rate increase.

Figure 18 shows how the accountability framework discussed in the introduction applies to principle 8 of the Action Plan for Safe Drinking Water in British Columbia: "safe drinking water should be affordable, with users paying appropriate costs."

Figure 18 **Principle 8: Safe drinking water should be affordable, with users paying appropriate costs**


Clear Objective
Ensure safe drinking water is affordable, with users paying appropriate costs
Effective Strategies
Phased approach to progressive improvement, facilitating budget cycles
Treatment options to meet water quality objectives at the discretion of the water supplier and consumers
Fiscal accountability of local government, Improvement Districts and private utilities
Real Consequences
Performance Measurement and Reporting
Provincial Health Officer's report
Water supplier reports
Aligned Management Systems
Funding assistance to municipalities available through the Canada-British Columbia Infrastructure Program
Oversight of water rates by the Ministry of Environment
Oversight of financial viability by Ministry of Community Services

Progress and accomplishments related to each component are discussed in Section 8.3.

8.3 Progress and Accomplishments 2003/2004 and 2004/2005

8.3.1 Effective Strategies

A number of strategies are in place to meet the objective of ensuring safe drinking water is affordable with users paying appropriate costs. These strategies include a phased approach to progressive improvement that facilitates budget cycles; treatment options for water suppliers and consumers to decide how best to meet water quality objectives; low costs for rights to surface water sources; and no fees for rights to groundwater sources.

During 2003/2004 and 2004/2005, drinking water officers continued programs of inspection and assessment of water supply system needs and identified priorities for water supplier action to improve infrastructure and operations. The approach taken has been to require suppliers to engage in progressive improvements—addressing higher risks as a priority and developing long-term plans. This approach enables water suppliers to both develop budgets that accommodate long-range needs and to develop the most cost-effective strategies to meet water quality targets.

Water suppliers are encouraged to develop rate structures that allow funding reserves to accumulate to meet future needs. Utilities, local government water suppliers and improvement districts have in place accountability structures to oversee the use of those reserves. Water utilities are

required to submit annual financial reports to the Ministry of Environment; local governments and improvement districts are required to submit them to the Ministry of Community Services.

One aspect of current legislation that helps to make water affordable is the low cost for rights to access surface water sources (currently the annual rate for waterworks purposes is $1.10 per 1,000 cubic metres). There are no fees for accessing groundwater. The fact that groundwater has no license fee acts as an incentive for water suppliers to move toward groundwater sources. These sources are generally more protected from microbial contamination than surface water.

8.3.2 Aligned Management Systems

The provincial government and local authorities have partially aligned their management systems through funding assistance to municipalities through the Canada-British Columbia Infrastructure Program. However, since only local governments have access to government funding, many suppliers cannot access these grants unless they hand over their assets to local governments. For their part, local governments are cautious about the liabilities associated with taking on responsibility for these supplies. Health authorities and the Ministry of Community Services encourage local governments to either assist small water supply system owners or to take ownership of systems.

In early 2005, the Ministry of Community Services (then Ministry of Community, Aboriginal and Women's Services) announced a new BC Community Water Improvement Program to bridge a gap in federal/provincial funding. This funding is available to local governments. Other water suppliers can transfer their assets to their local government to access these programs or obtain planning grants through their local government. For more information, see Section 5.3.2.

8.3.3 Performance Measurement and Reporting

No specific, overarching indicators of progress are available on this issue for 2003/2004 or 2004/2005. In general, water suppliers continue to be encouraged by health authorities and government ministries to develop better budgets and adjust water rates as needed.

Local government water supply systems tend to function on a full-cost accounting basis, and users generally benefit from the economies of scale that allow major infrastructure projects to be funded by a large number of people. Access to infrastructure funding also allows these suppliers to improve water treatment without the need to bear the full costs of infrastructure improvements through water rates.

The per capita cost for improvements to treatment infrastructure for other water supply systems is higher as they cannot directly access federal/provincial infrastructure grant programs. While these suppliers could transfer ownership to local government, both parties are often reluctant to pursue this option; system owners and customers value their local autonomy, and local governments are reluctant to take on the liabilities associated with small systems that may not meet regulatory standards.

Smaller water suppliers, including some improvement districts and water utilities, often fail to budget for future infrastructure needs. The Small Water System Review Project included discussions with water suppliers related to rate structures. Many are budgeting solely for routine operation, often charging less than $100 per year, and where the water supply is part of a larger, commercial operation, such as a mobile home park, rates may be rolled into a total operations budget and have no breakdown for actual water supply expenses.

A number of recommendations are made in Section 8.4 to encourage progress in future years.

8.3.4 Gaps

The provincial government, health authorities and water suppliers face a number of challenges in addressing the issue of full-cost accounting for public water supply systems in the province.

Currently no source of training is readily available for managers of smaller water supply systems. Many operator courses discuss financial management issues, but courses for water system managers in British Columbia have not been developed. This gap means that many water suppliers lack advice and support on what they are accountable for, how to identify water system needs, how to develop appropriate

revenue streams, how to prioritize expenditures and how to report to water users so that they are aware of the true cost of providing safe water. This latter consideration is critical as it perpetuates the low water rates that prohibit full-cost accounting. Where water users are involved in setting their rates, they often place greater value on maintaining low water rates than on improving their water supply system.

8.4 Recommendations

17. To follow up on the Action Plan for Safe Drinking Water in British Columbia, public drinking water system suppliers should engage their customers in fiscal planning for maintaining and upgrading their systems over the short- and long-term. In addition, small water supply systems should be offered assistance to develop revenue streams to fund assessments, response plans and system upgrades.
Leads: Ministry of Health, Ministry of Community Services and water suppliers.

18. Rates for drinking water should reflect the true, long-term, costs of water treatment, distribution and water system operation, maintenance and monitoring. Revenue generated from charges for water should be re-invested in programs that promote awareness of water quality and quantity, protect water quality, improve public health and encourage sustainable water use to promote healthy communities.
Lead: Ministry of Community Services.

9. Recommendations

1. Provincial and federal government commitments to the Environmental Farm Plan Program should remain a priority, with a target of all farms participating in the program.
   Lead: Ministry of Agriculture and Lands.

2. The Ministry of Environment should continue to expand its activities to support drinking water officers in meeting government's source protection commitments and report out to the public on its activities. Staff at the regional level should have a clear understanding of their role in providing support to water suppliers and drinking water officers in their source protection activities.
   Lead: Ministry of Environment.

3. To ensure comprehensive management of BC's drinking water sources, especially where water quantity is threatened, government should introduce legislation requiring the licensing of groundwater extraction and restricting access to groundwater where aquifers are being over-used. Groundwater licensing should complement surface water licensing.
   Lead: Ministry of Environment.

4. Government should improve monitoring of the impacts of resource activities on drinking water sources to ensure adverse impacts on water quality can be identified. Clear responsibilities for monitoring need to be established and the parties responsible for adverse impacts on water supplies should be held accountable.
   Leads: Ministry of Environment and Assistant Deputy Ministers' Committee on Water.

5. The Ministry of Environment and Ministry of Agriculture and Lands should work to gain a better understanding of how different land use practices can influence drinking water sources.
   Leads: Ministry of Environment, Ministry of Agriculture and Lands, Ministry of Health, and research and granting agencies.

6. Government should complete the process for water management plan development to include groundwater and surface water source areas. This process should accommodate formal planning under both the *Water Act* and the *Drinking Water Protection Act*, as well as planning occurring outside of a statutory decision. Where source water assessments show drinking water sources to be at risk from land use, or where source contamination has led to water quality advisories or identified outbreaks, watershed management plans should be developed.
   Leads: Ministry of Environment, Ministry of Health and water suppliers.

7. The systematic collection of better information about drinking water quality conditions in the province is needed. The drinking water information management project needs to be completed to ensure drinking water officers and the Provincial Health Officer have ready access to all data needed to administer and report on activities under the *Drinking Water Protection Act*. These data include those needed to hold water suppliers, drinking water officers and the government accountable through public reporting.
   Leads: Ministry of Health and Ministry of Environment.

8. Where government activities affect the safety of drinking water, the decision makers responsible for the activity must ensure that they involve the appropriate health officials, either within the Ministry of Health or within the regional health authority.[7]
Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water.

9. All ministries and government agencies should regularly review their activities in the context of government's commitment to an integrated approach to drinking water protection.
Lead: Directors' Inter-Ministry Committee on Drinking Water.

10. All government policy decisions related to land use or water management which could have an impact on the province's drinking water program should be taken to the Assistant Deputy Ministers' Committee on Water to ensure that policy direction is consistent with the Action Plan for Safe Drinking Water in British Columbia. The work of the Committee should be made more transparent; its decisions should be made publicly available.
Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water.

11. All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans health authorities should require water suppliers relying on surface water sources to plan for treatment capable of achieving 99.99 per cent reduction in virus levels, 99.9 per cent reduction in protozoa levels and turbidity levels below 1NTU, through treatment processes involving at least two barriers, unless there is good justification, acceptable to the Drinking Water Officer, for not achieving those levels.
Lead: Health authorities.

12. Government should consider options to improve access to funding support for public water supply systems that are currently ineligible for federal/provincial infrastructure assistance.
Lead: Ministry of Community Services.

13. Based on the needs identified by assessments and the requirements stipulated on operating permits, water suppliers should implement or expand treatment performance monitoring to include variables such as CT,[8] filtration performance, turbidity, UV performance, pH and pressure regimes as appropriate.
Leads: Water suppliers, drinking water officers.

14. To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged.
Leads: BCCDC and the EWQA Program.

15. Government should undertake to develop an accurate inventory of BC's small public drinking water supply systems and obtain all of the data identified as part of the drinking water information management project core data set.
Leads: Health authorities, Ministry of Health.

16. Strategies should be developed to prevent the creation of new small water supply systems where other supplies could be expanded or existing supplies amalgamated. These strategies should include regulatory amendments that:

    a. Prohibit the creation of multiple small water supply systems where one larger system could be developed.

    b. Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.

    c. Provide authority to require developers to connect new properties with existing adjacent water supply systems.

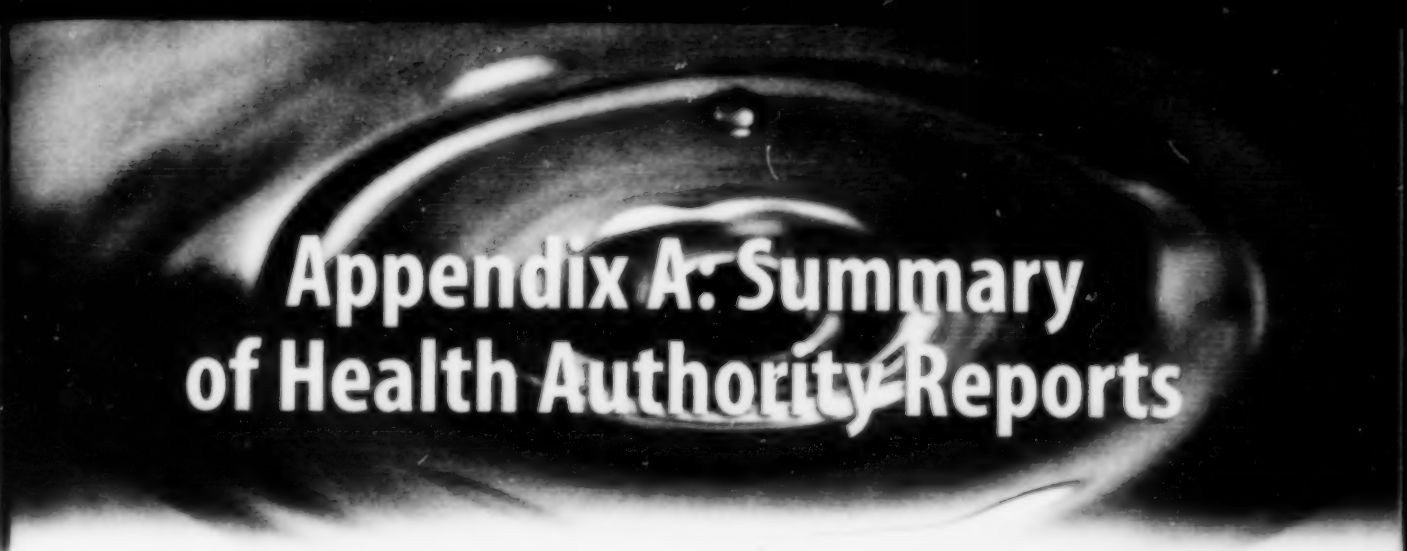
Lead: Ministry of Community Services.

[7] *As of October 2006, a Memorandum of Understanding was being developed.*

[8] *CT is a measure of disinfectant concentration and time that the disinfectant is in contact with treated water prior to reaching the first consumer. Tables have been developed that establish the appropriate CT to achieve pathogen reduction under various conditions of temperature and pH.*

17. To follow up on the Action Plan for Safe Drinking Water in British Columbia, public drinking water system suppliers should engage their customers in fiscal planning for maintaining and upgrading their systems over the short- and long-term. In addition, small water supply systems should be offered assistance to develop revenue streams to fund assessments, response plans and system upgrades.
Leads: Ministry of Health, Ministry of Community Services and water suppliers.

18. Rates for drinking water should reflect the true, long-term, costs of water treatment, distribution and water system operation, maintenance and monitoring. Revenue generated from charges for water should be re-invested in programs that promote awareness of water quality and quantity, protect water quality, improve public health and encourage sustainable water use to promote healthy communities.
Lead: Ministry of Community Services.



Appendix A: Summary of Health Authority Reports

The Office of the Provincial Health Officer provided each of the five regional health authorities with a questionnaire to help them report on a standard set of information for the 2003/2004 fiscal year. This appendix is a summary of the information received. Data for 2004/2005 is included in the text of the report, and not summarized in this appendix.

Because 2003/2004 was the first year the health authorities were asked to provide detailed information on various aspects of their public water supply systems, the health authorities confronted a number of challenges in collecting and reporting meaningful data. In addition, data collection methods varied from region to region. These factors have meant that, in some instances, the data provided are not comparable across the province. In other cases, data are simply not available.

This appendix reflects the information from the reports that can be compared with some reliability. In future years, as data collection and reporting become standardized, more information on BC's public water supply systems will be made available.

Categories of public water supply systems:

WS1 = More than 300 connections

WS2 = 15 to 300 connections

WS3 = Fewer than 15 connections, but more than one

WS4 = One connection

1. The number of water systems, by category

Health Authority	Number of Water Systems, by Category**				
	WS1	WS2	WS3	WS4	Total
Vancouver Coastal	23	68	144	–	235
Fraser*	27	103	178	111	419
Vancouver Island	53	189	266	316	824
Interior	83	451	880	–	1,417
Northern	37	132	442	391	1,002
Total	223	943	1,913	878	3,957

*Fraser Health Authority information is reported for the period of May to October 2003 only.

**A dash ("–") indicates a blank where a health authority did not provide information.

2. Hazard ratings of water systems, by category

Health Authority	Category	Number of Systems	Hazard Rating			
			High	Medium	Low	Not Rated
Vancouver Coastal*	WS1	23	1	5	16	1
	WS2	68	17	6	45	
	WS3	144	21	37	64	22
	WS4					
Fraser	WS1	27	0	1	14	11
	WS2	103	5	27	38	33
	WS3	178	7	32	53	86
	WS4	171	4	20	34	113
Vancouver Island*	WS1	53	0	3	38	–
	WS2	189	8	11	121	–
	WS3	266	8	19	109	–
	WS4	316	0	2	36	278
Interior**	WS1	83	1	52	30	–
	WS2	451	84	250	117	
	WS3	883	137	507	239	–
	WS4					
Northern**	WS1	37	0	4	25	8
	WS2	132	10	19	91	12
	WS3	442	11	40	297	94
	WS4	391	5	10	250	106
	Total	3,957	319	1,065	1,617	486+

Notes:

* Low indicates no critical hazards were found during the last inspection. Medium suggests some maintenance issues or critical hazards were noted during the last inspection. High indicates that critical hazards were found by the Environmental Health Officer, who deemed them serious enough to potentially put the public at risk.

** Rating system looked at inherent risk of systems based on microbiological history, emergency response plans, source water considerations, treatment effectiveness, engineering standards, management and maintenance, population served and operator certification.

3. Number of full-time equivalent (FTE) positions in each health authority, by type of position

	FTEs by Type of Position					
Health Authority	Drinking Water Officers*	Management	Technical**	Public Health Engineers	Clerical	Total
Vancouver Coastal	4.00	–	–	1.00	–	5.00
Fraser	6.00	1.00	2.43	1.00	1.40	11.83
Vancouver Island	5.25	–	–	–	–	5.25
Interior	24.00	2.00		4.00	2.00	32.00
Northern	–	–	–	–	–	5.68***

Notes:

* Includes medical health officers, drinking water officers, environmental health officers and public health inspectors.

** Includes technical specialists and water samplers.

***Only the total was provided.

4. Number of boil water advisories in each health authority, by category of system, for November 2003

Health Authority	Category	Number of Systems	Number of Advisories
Vancouver Coastal	WS1	23	5
	WS2	68	24
	WS3	144	33
	WS4		
Fraser	WS1	27	0
	WS2	103	23
	WS3	178	19
	WS4	171	12
Vancouver Island	WS1	53	0
	WS2	189	18
	WS3	266	14
	WS4	316	9
Interior	WS1	83	2
	WS2	451	68
	WS3	883	119
	WS4		
Northern	WS1	37	1
	WS2	132	19
	WS3	442	21
	WS4	391	6
	Total	3,957	393

5. The number of water systems, by category, non-compliant with the microbiological schedule (Schedule A, Drinking Water Protection Regulation)

Health Authority	Category	Number of Systems	Number of Non-Compliant Systems
Vancouver Coastal	WS1	23	4
	WS2	68	11
	WS3	144	8
	WS4		
Fraser	WS1	27	0
	WS2	101	17
	WS3	178	17
	WS4	121	21
Vancouver Island*	WS1	53	0
	WS2	189	18
	WS3	266	14
	WS4	116	9
Interior**	WS1	83	2
	WS2	451	74
	WS3*	883	136
	WS4		
Northern	WS1	37	0
	WS2	132	8
	WS3	442	18
	WS4	891	31
	Total	3,957	368

Notes:

* Reflects number of boil water advisories.

**Reflects "frequent positive results."

6. Number of water systems, by category, with emergency response plans

Health Authority	Category	Number of Systems	Number of Emergency Response Plans**
Vancouver Coastal	WS1	23	10
	WS2	68	6
	WS3	144	5
	WS4		
Fraser	WS1	27	25
	WS2	103	26
	WS3	178	64
	WS4	171	11
Vancouver Island*	WS1	53	–
	WS2	189	
	WS3	266	–
	WS4	316	
Interior**	WS1	83	43
	WS2	451	77
	WS3	883	82
	WS4		
Northern	WS1	37	19
	WS2	132	13
	WS3	442	19
	WS4	391	3
	Total	3,957	425

Note:

* Water supply systems on Vancouver Island do have emergency response plans, but accurate counts of existing plans were not possible in 2003/2004.

**Identified as "meets system needs."

7. Number of water systems, by category, with conditions on operating permits

Health Authority	Category	Number of Systems	Number With Conditions on Operating Permits
Vancouver Coastal	WS1	23	6
	WS2	68	0
	WS3	144	0
	WS4	-	-
Fraser	WS1	27	1
	WS2	103	-
	WS3	178	1
	WS4	171	-
Vancouver Island	WS1	53	-
	WS2	189	-
	WS3	266	-
	WS4	316	-
			Total Vancouver Island: 11*
Interior	WS1	83	29
	WS2	451	-
	WS3	883	-
	WS4	-	-
Northern	WS1	37	0
	WS2	132	1
	WS3	442	2
	WS4	391	1
		Total 3,957	52

Note:

* Total for Vancouver Island not split out by water system size.

8. The number of boil water orders, by category of water system, issued by drinking water officers under the authority of the *Drinking Water Protection Act*

Health Authority	Category	Number of Systems	Number of Orders
Vancouver Coastal	WS1	23	*
	WS2	68	*
	WS3	144	*
	WS4	-	*
Fraser	WS1	27	0
	WS2	103	0
	WS3	178	0
	WS4	171	0
Vancouver Island	WS1	53	-
	WS2	189	-
	WS3	266	-
	WS4	316	-
			Total Vancouver Island: 3**
Interior	WS1	83	-
	WS2	451	-
	WS3	883	-
	WS4	-	-
			Total Interior: 3**
Northern	WS1	37	0
	WS2	132	0
	WS3	442	0
	WS4	391	0
		Total 3,957	8

Note:

* Data not available.

** Data provided without breakdown by size of water system.

9. Availability of water system information on a website

Fraser Health Authority:	Drinking water reports and general information available at http://www.fraserhealth.ca/Healthinfo/PublicHealth/HealthProtection/default.htm
Interior Health Authority:	Drinking water reports and boil water advisory information available at http://www.interiorhealth.ca/Health+and+Safety/Drinking+Water/
Northern Health Authority:	Drinking water reports and boil water advisory information available at http://www.healthspace.ca/nha
Vancouver Coastal Health Authority:	Information from Coast Garibaldi area is available at http://www.healthspace.ca/coastgaribaldi
Vancouver Island Health Authority:	General information and water quality advisories available at http://www.viha.ca/mho/environment/water_quality/

Water suppliers regularly post reports about their water supply systems on their own website.

Appendix B: British Columbia Centre for Disease Control Activities

British Columbia Centre for Disease Control Report 2003

The British Columbia Centre for Disease Control (BCCDC) is an integrated public health agency in the Provincial Health Services Authority that has the responsibility to support a comprehensive program of communicable disease and environmental health prevention and control for the province of British Columbia. BCCDC works in close partnership with the province's health authorities, Medical Health Officers and the Provincial Health Officer.

Drinking water-related activities include provision of operational and policy advice on health risks from drinking water to Ministry and health authority staff. The Director of Environmental Health at BCCDC is the British Columbia representative on the Federal-Provincial-Territorial Committee on Health and Environment. This is the parent committee to the Federal-Provincial-Territorial Committee on Drinking Water.

BCCDC Laboratory Services carries out many activities to support safe drinking water, including:

- **Environmental Microbiology Laboratory**
  This group multi-tasks between food poisoning activities (botulism, Norovirus RT PCR, consultations, outbreak and cluster investigation and Food Quality Check) and water activities (audits, specific pathogen tests, drinking water monitoring, testing of beaches and pools, detection and investigation of waterborne outbreaks as well as leadership in the Enhanced Water Quality Assurance (EWQA) Program, education and research on enhanced surveillance for drinking water quality and waterborne outbreaks).

- **Clinical Laboratory**
  Many other sections of BCCDC Laboratory carry out testing on patient samples.

- **Molecular Epidemiology/Outbreak Coordination**
  This team, along with its partners in public health, environment and agriculture, uses state-of-the-art molecular testing tools and methods in risk assessment projects. While the focus is on microbial contamination, the approach is targeted at enhancing surveillance. A key member of this team is the outbreak coordinator who works closely with Environmental Health Officers and other public health experts to coordinate the BCCDC-wide response to outbreaks or clusters of gastrointestinal disease throughout BC.

- **Drinking Water Microbiology Laboratory Approval**
  The BC public health leadership role in laboratory quality assurance for drinking water testing was recognized by the Walkerton Inquiry. For many years, the Office of the Provincial Health Officer, in collaboration with BCCDC laboratory leaders, has led an Advisory Committee on Drinking Water Approval, renamed the Enhanced Water Quality Assurance (EWQA) Program in 2001. It is a peer-review program reporting to the Provincial Health Officer. The approval process is a requirement of the Drinking Water Protection Regulation.

  EWQA makes recommendations on laboratory approval for drinking water testing done for public health purposes. This model is recognized widely across Canada, and a recent survey of Canadian Public Health Laboratory Network (CPHLN) Laboratory Directors agreed that, since drinking water was a health issue, this model should

be available to other provinces. The CPHLN Water and Food Safety Subcommittee is now working with all Chief Medical Health Officers and Public Health Laboratory Directors to strengthen the role of health professionals in all provinces across Canada. EWQA is now also working to harmonize its activities with other accrediting bodies and is working towards registration with an International Quality Standard (ISO).

BCCDC Laboratory Services supports the EWQA program and works closely with the Clinical Microbiology Proficiency Testing Program. Many of the BCCDC Laboratory Services staff are peer-reviewing expert auditors. Annual Auditor Training Workshops (20 or more registrants) at BCCDC receive excellent evaluations.

- **Drinking Water Laboratory Network Development and Management**

  Since the enactment of the *Drinking Water Protection Act* and Regulation, the number of samples collected for microbiological testing of drinking water has risen dramatically. Further increases are anticipated as smaller public water supply systems increase testing frequencies.

  In order to expand laboratory capacity province-wide to meet this growth in drinking water testing, the EWQA, supported by the BCCDC, proposed development of a Quality Laboratory Network. This Network continues to grow, building on the principles of private-public partnerships, regional laboratories in a network with different levels of testing (screening test only, routine testing and public health/reference testing) and Quality Assurance through the Office of the Provincial Health Officer. BCCDC Laboratory Services has a strong history of partnerships with private laboratories (current contracts with private laboratories approved by the Provincial Health Officer in the Northern Health Authority, Vancouver Island Health Authority and Interior Health Authority).

  Since government has stated that the Action Plan for Safe Drinking Water in British Columbia should be funded on a user-pay, cost-recovery basis, this EWQA-led Quality Network will evolve carefully to maintain strong levels of service.

  Most recently BCCDC Laboratory Services hosted more than 30 Environmental Health Officers in a seminar on water microbiology. Distance education material is being developed in collaboration with Simon Fraser University, the British Columbia Water & Waste Association (BCWWA) and the University of British Columbia. Long-term network development will be carried out with the Ministry of Health's leadership in BC's "Laboratory Modernization" initiative, as the Provincial Health Services Authority's (PHSA) BCCDC site (BCCDC Laboratory Services) works closely with the Provincial Laboratory Coordinating Office.

- **Laboratory Drinking Water Informatics**

  PHSA Laboratories are working closely towards integration of services to optimize and build on the work of each of their agencies. Part of this integration is the purchase and implementation of a new Laboratory Information System (LIS). The new LIS will address improved utilization management, better public health surveillance, patient-focused testing and eventual interfacing of environmental and clinical data. The BCCDC Healthy Water Coordinator is on the BCCDC Laboratory Informatics Program and as well works closely with the Ministry of Health drinking water information management project. The Coordinator is currently working with the drinking water information management project's Regional Health Authorities Working Group to help set up a common data set, and represents BCCDC and the Quality Laboratory Network's interests in the data model. BCCDC Laboratory Services also works with the national Drinking Water Informatics Group towards a national surveillance and compliance monitoring system.

- **Drinking Water Research, Education and Expert Committee**

  BCCDC Laboratory Services was recently awarded two Canadian Institutes of Health Research grants related to improving drinking water surveillance and assessing the impact of contamination on community health. These multidisciplinary grants involve partners across Canada. A three-year research project is also underway with the Alberta Public Health Laboratory and the University of Calgary on source-to-tap drinking water surveillance. These national studies build on years of BC-

wide collaboration with public health workers. Ongoing collaborations continue with the Greater Vancouver Water District.

BCCDC Laboratory Services, supported by the Canadian Water Network (CWN), hosts popular graduate student networking lunches on drinking water. Many different UBC faculties are represented, from medicine to geography to political science. A recent presentation highlighted Risk Perceptions in the Creston Community.

Many academic presentations on drinking water have been made in 2003/2004 at provincial and national conferences. Meetings included the BCWWA, CWN Conference, Canadian Association for Clinical Microbiology and Infectious Diseases.

Appendix C: Canada–British Columbia Water Infrastructure Projects

British Columbia Water Infrastructure Upgrades 2001-2004

Under the Canada-British Columbia Infrastructure Program, signed in October 2000, the federal, provincial and local governments planned to jointly invest a total of $800 million over a five-year period in municipal infrastructure in urban and rural communities across the province. About 75 per cent of the program's funding was earmarked for "green" projects—with the major emphasis on improving water and wastewater supply systems, thereby strengthening drinking water protection in BC. By April 2004, 274 infrastructure projects with a value of nearly $791 million had been approved, of which 80 per cent were for "green" projects.

To date, some 150 projects involved improvements to water quality, water distribution systems and wastewater management for a total cost of $606 million. Many of the earlier funded projects listed here are just being completed now. As a result, the water quality of dozens of communities in BC has already improved or will be improved soon. Some have been able to come off boil water advisories for the first time in years. Other projects will take a number of years to complete.

Under the program, funding is split so that one-third comes from the federal government, one-third from the provincial government, and one-third from the local district receiving the upgrade. It builds on the previous Canada-British Columbia Infrastructure Works Program, which invested $825 million in British Columbia. The following drinking water projects were announced in 2003 and 2004. Most projects were subject to environmental assessments before proceeding. Not all types of work are eligible for funding and only the amount for each project that meets eligibility criteria is reported here.

Kootenay Region

- **Town of Creston** – The town will receive approximately $1.2 million to build a new enclosed reservoir with chlorinator capability to replace an existing open reservoir. This new reservoir will ensure treated water is not exposed to potential contamination. The project's total eligible cost for program funding is nearly $1.8 million. Status: 80 per cent completed by Summer of 2006.
- **City of Rossland** – The city will receive approximately $2 million to build a new open reservoir and upgrade the Topping Creek and Murphy Creek water intakes. This project will improve water supply delivery and provide additional storage capacity to allow for future community growth. The project's total eligible cost for program funding is nearly $2.9 million. Status: Construction delayed, seeking amendments.
- **District of Elkford** – The district received approximately $359,000 to install oversized water mains on the downstream side of the district's chlorine disinfection stations. This ensures adequate chlorination contact time and should eliminate the seasonal boil water advisory placed on the system by the health region. The project's total eligible cost for program funding was more than $538,000. Status: Successfully completed.

- **Regional District of Central Kootenay McDonald Creek/Kaslo** – The regional district received approximately $609,000 for a new source of domestic water for the residents of McDonald Creek. The project provides residents with a reliable source of safe drinking water. The project's total eligible cost for program funding was more than $913,000. Status: Over 90 per cent complete.
- **City of Kimberley** – The city received approximately $407,000 to replace the 60-year old woodstave water main with PVC waterline to improve system reliability and reduce water loss in the system. The project's total eligible cost for program funding was nearly $611,000. Status: Successfully completed.
- **Regional District of Central Kootenay – Ymir** – The regional district received approximately $221,000 to develop a groundwater well, construct a pump station and connect to the distribution system. This provided a reliable source of safe drinking water to 150 properties. The project's total eligible cost for program funding was more than $332,000. Status: Began construction in 2006.
- **City of Fernie** – The city received approximately $627,000 to replace and extend a water trunk main through West Fernie to existing and proposed developments. This improved system reliability and fire protection, and provides for future community growth. The project's total eligible cost for program funding was nearly $941,000. Status: Successfully completed.
- **District of Invermere** – The district received approximately $1.4 million for groundwater well development, construction of a 500,000 Imperial gallon water reservoir, installation of approximately 1,000 metres of transmission mains and a booster pump station to improve water quality and provide for future community growth and improved fire protection. The project's total eligible cost for program funding was $2 million. Status: As of 2006, project not started; waiting for completion of federal environmental review process.

Lower Mainland/Southwest Region

- **City of West Vancouver** – The regional district will receive $3 million to build a membrane filtration water treatment facility. The project will improve system reliability and water quality. The project's total eligible cost for program funding is $4.5 million. Status: Some site preparation – may abbreviate scope.
- **District of Kent (Aggassiz)** – The district received approximately $6 million to develop a groundwater source, a storage reservoir and a water distribution system to ensure potable water, and improve fire protection. These improvements allow for future growth of the community. The project's total eligible cost for program funding was nearly $9 million. Status: 70 per cent complete.
- **Village of Harrison Hot Springs** – The village received approximately $435,000 for improvements to water and sewer systems to improve system reliability and increase the capacity of the facilities for future development of the community. The project's total eligible cost for program funding was $653,000. Status: Approximately 30 per cent complete – held up due to scope changes.
- **Sunshine Coast Regional District – Mercer Road** – The regional district received approximately $577,000 to extend the Sunshine Coast Regional District water supply to the Mercer Road area. The project provides safe drinking water to 32 properties relying on private wells, the majority of which had arsenic levels above acceptable limits set out in the *Guidelines for Canadian Drinking Water Quality*. The project's total eligible cost for program funding was more than $866,000. Status: Successfully completed.

Nechako

- **Village of Fraser Lake** – The village received approximately $815,000 to design and build a new water treatment plant. The project ensures that water drawn from the Fraser Lake is treated sufficiently, providing safe drinking water for residents. The project's total eligible cost for program funding was more than $1.2 million. Status: Delayed due to referenda, detailed design underway in the fall of 2006.

- **Village of Telkwa** – The village received approximately $465,000 towards a new water treatment plant and intake on the Bulkley River. The project improves water quality to 550 households. The project's total eligible cost for program funding was $697,000. Status: Successfully completed.

North Coast

- **City of Terrace** – The city will receive approximately $900,000 to build a water well and pump house. The project will provide the community with a safe and reliable secondary source of drinking water. The project's total eligible cost for program funding is more than $1.3 million. Status: 98 per cent complete.
- **Regional District of Kitimat-Stikine – South Hazelton (Phase 1)** – The Regional District of Kitimat-Stikine will receive approximately $344,000 to upgrade the community's water system and increase its capacity. The project will improve system reliability and fire protection. The project's total eligible cost for program funding is more than $515,000. Status: Delayed – almost ready to start in late 2006.
- **Village of Queen Charlotte City** – The Skeena-Queen Charlotte Regional District will receive approximately $577,000 to build a new water reservoir, and supply and install backup generators at three separate locations. This project will improve system reliability and efficiency, fire protection and water conservation in the community. The project's total eligible cost for program funding is $865,000. Status: 80 per cent complete.
- **Regional District of Kitimat-Stikine – South Hazelton (Phase 2)** – The regional district received approximately $373,000 to upgrade the South Hazelton water system, including constructing a chlorination disinfection facility and a balancing reservoir. The project improves system reliability and water quality for 193 properties. The project's total eligible cost for program funding was $515,790. Status: Project delayed; scope being amended in 2006.
- **Regional District of Skeena Queen Charlotte – Sandspit** – The regional district received approximately $1.9 million for a new community water supply and distribution system to replace privately owned/operated water wells susceptible to surface water contamination. The project improves drinking water quality and fire protection for 230 residents. The project's total eligible cost for program funding was nearly $2.9 million. Status: Successfully completed.

Northeast

- **Regional District of Northern Rockies – Fort Nelson** – The regional district received approximately $2.1 million to extend the existing Fort Nelson water system in order to provide safe drinking water to 32 properties in the 292 Subdivision, and another 64 properties with inadequate private systems along the Alaska Highway. The project's total eligible cost for program funding was nearly $5.2 million. Status: Approximately 60 per cent complete.
- **District of Taylor** – The district received approximately $77,000 to convert the existing water treatment plant and pump house from propane heating to solar heating. The project reduces operating costs and greenhouse gas emissions. The project's total eligible cost for program funding was more than $115,000. Status: 80 per cent complete.

Thompson-Okanagan Region

- **City of Kelowna** – The city received approximately $3 million to improve its water system by installing ultraviolet disinfection equipment at three existing lake intakes. The project improves system reliability and efficiency. The project's total eligible cost for program funding was more than $4.4 million. Status: Successfully completed.
- **City of Merritt** – The city received approximately $576,000 to develop a new groundwater source to provide a safer, more reliable water source for the community. The project's total eligible cost for program funding was more than $864,000. Status: 25 per cent complete.

- **Regional District of Columbia-Shuswap – Saratoga** – The regional district received approximately $413,000 to install a new water intake in Shuswap Lake, make improvements to the pump house and construct a balancing reservoir. The project improves water quality and fire protection. The project's total eligible cost for program funding was $620,000. Status: Successfully completed.

- **Thompson-Nicola Regional District - Vavenby** – The regional district received approximately $300,000 to link the Vavenby water system and the Vavenby Southside water system. The project improves water quality and system reliability. The project's total eligible cost for program funding was $449,900. Status: Successfully completed.

- **District of Summerland** – The Corporation of the District of Summerland received approximately $7.6 million to construct water treatment facilities, to ensure a greater capacity of potable water for the community, thus allowing for future development. The project's total eligible cost for program funding was $11.4 million. Status: Construction began in summer of 2006.

- **District of Logan Lake** – The district received approximately $45,000 for improvements to its water system to improve water quality and fire protection. As well, the project provided water service to a potential development area where affordable and special needs housing was being considered. The project's total eligible cost for program funding was $67,000. Status: Successfully completed.

- **Regional District of North Okanagan – Gunter-Ellison Water Extension Enderby** – The Regional District of North Okanagan received $100,000 to extend the city of Enderby's water system to residents whose on-site wells have inadequate quantity and quality of water, and to improve economic and environmental sustainability of the area. The project's total eligible cost for program funding was $150,000. Status: Successfully completed.

- **Town of Oliver** – The town received approximately $1.2 million for the expansion of the town's reclaimed water irrigation system to provide a more cost-effective way of managing reclaimed water, and conserve domestic water supply. The project's total eligible cost for program funding was nearly $1.8 million. Status: Successfully completed.

- **Village of Lumby** – The village received approximately $1.2 million to complete water system upgrades, including construction of a new deep production well to provide the community with improved water supply. The project's total eligible cost for program funding was $1.8 million. Status: Late start due to federal environmental assessment process; project approximately 60 per cent completed in 2006.

Vancouver Island/Coast

- **Capital Regional District – Salt Spring Island (Fulford Harbour)** – The Capital Regional District will receive approximately $972,000 to upgrade the existing Fulford Harbour water system. The project will improve system reliability and allow the system to consistently meet the standards set by the *Guidelines for Canadian Drinking Water* Quality and the Drinking Water Protection Regulation. The project's total eligible cost for program funding is nearly $1.5 million. Status: 40 per cent complete.

- **Capital Regional District – Salt Spring Island (Beddis)** – The Capital Regional District will receive approximately $507,000 to improve the Beddis drinking water system. The project includes building a new reservoir, installing a new chlorination system, other associated pipe-work and a new filtration system. The new treatment facility will ensure the water meets the *Guidelines for Canadian Drinking Water Quality*. The project's total eligible cost for program funding is more than $760,000. Status: Approximately 40 per cent complete, progress halted for shortage of funds.

- **Town of Ladysmith** – The town will receive approximately $1.4 million for Phase 1 of upgrades to the existing Ladysmith/Saltair drinking water system. This phase of the project includes building a new enclosed

reservoir, system upgrades and decommissioning of the existing open-air reservoir. The project's total eligible cost for program funding is more than $2.1 million. Status: Detailed design not finished.

- **Village of Sayward** – The village will receive approximately $476,000 to extend the water system and upgrade existing wastewater facilities at the Kelsey Bay wharf facilities. The project includes extending a water main to the wharf and installing one or two sewage lift stations and a force main. This project will help protect the environment and provide more economic opportunities for the community. The project's total eligible cost for program funding is nearly $714,000. Status: Successfully completed.

- **Central Coast Regional District – Bella Coola** – The regional district received $240,000 to provide a permanent source of domestic water to Bella Coola Townsite. This included drilling a new groundwater well to supplement two existing wells. The project improves water service to approximately 100 households. The project's total eligible cost for program funding was $360,000. Status: In 2006, detailed design almost completed.

- **District of Lantzville** – The district received approximately $1.3 million for improvements to its water supply system, including a new supply main on Harby Road to connect existing wells to a new dedicated supply main. The project provides increased capacity for future development and improves fire protection. The project's total eligible cost for program funding was more than $1.9 million. Status: 90 per cent complete.

- **Town of Port McNeill** – The town received approximately $970,000 to construct an additional well and storage reservoir to increase the reliability of the existing waterworks system. This provides improved fire protection and allows for future development in the community. The project's total eligible cost for program funding was nearly $1.5 million. Status: Construction not started.

- **District of Metchosin** – The district received $600,000 to extend community water service to a subdivision of 68 homes presently served by individual wells with unsatisfactory water quality and inadequate volume of supply. The new system will also provide fire protection. The project's total eligible cost for program funding was $900,000. Status: Successfully completed.

- **District of North Cowichan – Chemainus** – The district received approximately $2.4 million for the development of three production wells adjacent to the Chemainus River, construction of a new pump house, construction of a one million Imperial gallon reservoir and installation of water supply main and water main. The project benefits the community by providing a safer water supply, improving fire protection and improving system efficiency and reliability. The project's total eligible cost for program funding was $3.6 million. Status: Project delayed due to joint federal/provincial environmental review process.

- **Village of Port Alice** – The village received approximately $245,000 to replace its wood stave reservoir with a larger, steel-bolted reservoir, and install security fencing. The project benefits the community through increased water capacity to support growth and fire protection. The project's total eligible cost for program funding was $367,000. Status: Successfully completed.

- **Town of Sidney** – The town received approximately $649,000 for upgrades to the town's water system to improve fire protection, distribution system reliability and water quality. The project's total eligible cost for program funding was $974,000. Status: Successfully completed.

- **District of Tofino** – The district received approximately $4 million for water system upgrades to improve water quality and supply. The project's total eligible cost for program funding was $6 million. Status: 50 per cent complete.

Appendix D: Report on Ministries' Activities

Ministries' Activities in Support of the Action Plan for Safe Drinking Water in British Columbia from 2003 to 2005[33]

The provincial Action Plan for Safe Drinking Water in British Columbia presents a high-level framework for coordinating the actions of all provincial government agencies that have a role in the protection of drinking water quality. New relationships between government agencies involved with drinking water are being formed. As noted in the report, eight ministries play a role in ensuring the integrity of source waters:

- The Ministry of Health Services is designated the lead agency responsible for implementing the plan.
- The Ministry of Water, Land and Air Protection (MWLAP) is the lead agency for source protection.
- The Ministry of Agriculture, Food and Fisheries oversees farm management to prevent contamination from livestock and farming practices from entering surface and groundwater.
- Three ministries—Transportation, Forests and Energy and Mines – ensure that activities such as logging, mining or construction and/or maintenance of highway infrastructure does not degrade source waters nor introduce contaminants into the public water supply.
- The Ministry of Sustainable Resource Management ensures that land use planning activities address drinking water issues as paramount to other land use objectives.
- The Ministry of Community, Aboriginal and Women's Services is the lead agency for infrastructure improvements and access to funds for water system improvements, overseeing BC's role in the Canada-BC Infrastructure Program.

The following provides an outline of actions regarding drinking water by individual ministries. It outlines legislation governing each ministry's actions and responsibilities relating to water safety, what those actions are, what policies have been developed, what resources are being dedicated to the plan and how the ministry is collaborating with other government bodies.

1.0 Ministry of Transportation

1.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

The Ministry of Transportation's primary responsibility under the Action Plan is to continue to adhere to principle 2: Source protection is a critical part of drinking water protection. Ministry staff participate in the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water to ensure inter-ministry coordination of Drinking Water Protection Activities.

1.2 Relevant Drinking Water Safety Legislation

In carrying out construction and maintenance of transportation infrastructure, the ministry is governed by the federal *Fisheries Act* and the following provincial acts related to drinking water:

[33] *The names of the various ministries are those in use from 2003 to 2005.*

- *Fish Protection Act*
- *Water Act*
- *Environmental Management Act*
- *Waste Management Act*
- *Drinking Water Protection Act*
- *Transportation Act*

1.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

The Ministry of Transportation has long been supportive of better management and protection of drinking water. The ministry has been committed to following environmental assessments for its infrastructure projects for over 15 years and has issued manuals such as *Highway Environmental Assessment Process* and *A Guide to Environmental Referrals* to heighten awareness by ministry staff, contractors, agencies and stakeholders of environmental concerns, including safe drinking water and procedures around infrastructure developments.

Specific to drinking water, infrastructure projects such as road construction and routine (seasonal and yearly) maintenance activities routinely employ best management practices. Typically this includes development of sediment, drainage and erosion management plans, the installation of temporary and permanent roadside water treatment ponds and monitoring of these facilities to assess performance. This also includes identification of potential drinking water issues, such as residential wells and lakes or streams that are sources for local drinking water that may be impacted by a nearby infrastructure project. Once identified, measures are taken to ensure that drinking water quality and quantity is not compromised.

The Vancouver Island Highway Project followed this approach on the South Courtenay Connector. Wells were assessed and replaced where impacted by the highway project.

These policies and guidelines will continue to be followed and enhanced through adoption of new best management practices as they are developed by the Ministry of Transportation and others.

1.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

The following resources are committed by the Ministry of Transportation to the Action Plan for Safe Drinking Water in British Columbia:

- Staff participation in the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water.
- Project resources to ensure any nearby sources of drinking water are not compromised.

1.5 Collaborations with Other Ministries/Health Authorities

The Ministry of Transportation collaborates with the Ministry of Water, Land and Air Protection to establish and use best management practices on Ministry of Transportation projects in accordance with the Memorandum of Understanding established in 2002. Fisheries and Oceans Canada has also endorsed the best management practices to meet fish and habitat protection. These practices will be further enhanced in specific areas of the province to meet physical and biological diversity and values.

2.0 Ministry of Agriculture, Food and Fisheries

2.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

The Ministry of Agriculture, Food and Fisheries engages in a number of activities related to the Action Plan for Safe Drinking Water in British Columbia. These include:

- Environmental farm planning – development of planning assessment guides, planner training (three, two-week sessions), planner certification, Agriculture Policy Framework and National Farm Stewardship Program funding and development of third party delivery capacity to help farm organizations build the capacity to deliver this program to their members (through funding to hire planners). This type of planning leads to risk assessments

of farms and their water sources as well as improvements on farms that protect ground and surface water quality.

- Assessment of manure-loading practices in the Fraser Valley – Nutrient Management Committee, manure storage enhancement projects through the Agriculture Environment Initiative, Environmental Farm Planning. These projects protect surface and groundwater sources.
- Development of off-stream watering facilities – environmental farm planning, Agriculture Environment Initiatives projects, focus on *Water Act* licensing changes. These facilities protect surface waters.
- National Water Supply Expansion Program – Environmental farm planning, provincial agency in-kind funding, federal/provincial agreement. This program develops watering facilities to keep cattle from drinking in streams. It also results in dugouts and new wells.
- Water conservation – irrigation workshops, water metering, irrigation scheduling, irrigation technology, water balance model and climate monitoring. Demand management provides additional water for agriculture production and uses water more efficiently.
- Public/agency information – initiated development of a comprehensive water information web portal. Better information and water management tools provide for better water use planning and management.

2.2 Relevant Drinking Water Safety Legislation

None.

2.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

The following Ministry of Agriculture, Food and Fisheries programs, guidelines and policies support the Action Plan for Safe Drinking Water in British Columbia:

- Commitments in Ministry Service Plan:
  - "*Agriculture, food and fisheries industries that pursue resource development use best management practices to maintain high environmental standards.*" To meet this commitment, the Ministry develops and promotes the use of environmental farm plans and works with governments, ministries and agencies on legislation, policies and strategies dealing with water.
  - "*Developing and delivering programs on best farm practices related to the management of soil, waste and water.*" There are 18 farm organizations delivering environmental farm planning to farmers in BC. More than 1,000 plans have been completed and approved by BC farmers.
- Environmental Farm Planning Program – will provide a source-to-tap assessment of pollution risk for small public water supply systems on farms.
- Assessment of manure-loading practices in the Fraser Valley – protection of groundwater and surface water quality (pollution prevention).
- Development of off-stream watering facilities to keep livestock from drinking directly from creeks (pollution prevention).
- Increasing public water supply (quantum) and improving available water quality through supply enhancement.
- Water conservation promotion.
- A government/private sector internet portal dedicated to providing information about water.

2.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

The ministry has committed the following resources to meeting the objectives of the Action Plan for Safe Drinking Water in British Columbia:

- Agriculture Policy Framework funding to environmental farm planning. Ministry staff development of planner guides, planner training and program coordination. ($2.06 million for 2003/2004).
- National Water Supply Expansion Program ($5.5 million for 2003-2006).
- Agriculture Environment Initiative funding.
- Funding support for water portal website - $8,000.

2.5 Collaborations with Other Ministries/Health Authorities

Ministry of Agriculture, Food and Fisheries staff collaborate with other stakeholders on the following projects:

- **Environmental farm planning** – Ministry of Water, Land and Air Protection, Agriculture and Agrifood Canada, BC Agriculture Council
- **Assessment of manure loading** – Ministry of Water, Land and Air Protection, local governments
- **Off-stream watering** – Land & Water British Columbia, Inc., Ministry of Water, Land and Air Protection, Department of Fisheries and Oceans
- **National Water Supply Expansion Program** – Ministry of Forests, Ministry of Sustainable Resource Management, Ministry of Water, Land and Air Protection
- **Water conservation** – Ministry of Health Services, local governments
- **Water portal** – Ministry of Water, Land and Air Protection, Ministry of Sustainable Resource Management, Land & Water British Columbia, Inc., Ministry of Health Services

3.0 Ministry of Energy and Mines

3.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

No specific task/responsibility but the ministry participates on the Assistant Deputy Ministers' Coordinating Committee on Drinking Water, as required in the Action Plan.

3.2 Relevant Drinking Water Safety Legislation

Current and proposed legislation in the *Mines Act* and the *Petroleum and Natural Gas Act*, and the *Oil and Gas Commission Act* require the protection of provincial drinking water sources.

The *Mines Act* and Health, Safety and Reclamation Code address water protection and water quality issues with provisions made for community watersheds, riparian management, uranium exploration, terrain, water management and exploration access practices. Permits under the *Mines Act* are site specific and can be flexible to accommodate watershed, system and source issues.

Numerous provisions under the *Petroleum and Natural Gas Act* are intended to protect drinking water in wells drilled for oil and gas development, steel casing must be set below the base of strata known or expected to serve as a source of drinking water. The Oil and Gas Commission has the power to suspend use of a water source well that injuriously affects use of the water source for domestic or other purposes. There are a host of requirements to prevent pollution and, if spillage occurs, to remedy its cause or source, and restore and reclaim land or a watercourse affected by spillage.

3.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

Permitting processes for the mining and oil and gas sectors require protection of the environment and watercourses (i.e., protection at source). Environmental management plans are normally a requirement of the water licence and/or Crown land tenure for independent power projects and would address water quality concerns during construction with no resulting impact. The 2002 Energy Plan for BC (*Energy for Our Future: A Plan for BC*) supports industry environmental responsibility.

A mining exploration handbook has been developed that enhances riparian and watershed management practices. A guideline is being developed for aggregate operators regarding best practices around water discharges into receiving environments.

3.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

Staff participate on both the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water.

3.5 Collaborations with Other Ministries/Health Authorities

Collaboration occurs as required, on both an executive level and on a site-specific permitting level. The ministry collaborated with the Ministry of Water, Land and Air

Protection on reconnaissance baseline water quality monitoring in a few areas of coal bed gas potential and started a hydrogeological study in the Comox area.

4.0 Ministry of Health Services

4.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

As the lead ministry for drinking water, the Ministry of Health Services is heavily involved in moving forward the Action Plan for Safe Drinking Water in British Columbia. In brief, its responsibilities include: establishing committees as required, developing project plans, implementing the *Drinking Water Protection Act*, consulting with the health authorities and other groups, developing a water quality information reporting system, establishing tap water safety standards and monitoring, ensuring flexibility for small systems and assessing the ongoing costs and updating revenue streams for enhanced drinking water protection.

More specifically, in 2003/2004 these actions included:

- $2 million per year allocated to health authorities to create new positions to fill the job of drinking water officers; most positions are now filled, hiring underway for remaining positions (hiring taking place in the overall context of a re-organization of public health programs associated with amalgamation and streamlining of health authorities).
- Assistant Deputy Ministers' Coordinating Committee on Drinking Water (ADMCC) established. Meetings have been held on a monthly basis since the Action Plan was originally announced in June 2002. Meetings will now be held quarterly to address major policy issues.
- Directors' Inter-Ministry Committee on Drinking Water established to accommodate changing expectations with new legislation in force and new ADMCC Terms of Reference. This committee will continue to meet monthly to coordinate ongoing operational activities of government as they relate to the Action Plan for Safe Drinking Water in British Columbia.
- *Drinking Water Protection Act* training session held for public health inspectors, public health engineers and medical health officers; seven, one-day workshops held across the province.
- Policy and procedure manual initiated to guide drinking water officers in exercising their statutory mandate under the *Drinking Water Protection Act*. Contract with consultant.
- Letter sent by Minister of Health Services to all water suppliers for which health authorities had records. Letter provided update on new legislation and highlighted expectations of water suppliers.
- British Columbia Centre for Disease Control increased capacity to meet new microbiological sampling frequency. Protocols were developed to accommodate immediate reporting standard established by approved microbiological laboratories.
- Workshop held with drinking water officers and Ministry of Water, Land and Air Protection staff to develop business transition plan and work priorities.
- Drinking Water Leadership Council formed. Membership established and the first meeting held. Ministry of Health Services providing secretariat service.
- Partnership with British Columbia Water & Waste Association established to develop best practices documents for the water industry to aid with regulatory compliance.
- Source-to-Tap Assessment Team created a screening tool for assessment; transferred to Drinking Water Leadership Council for implementation.
- Ministry of Health staff provided presentations at meetings, workshops and seminars; BC Medical Association, British Columbia Water & Waste Association (BCWWA), Water Supply Association of BC, Coastal Water Suppliers Association, Canadian Bar Association, University of Victoria.
- Small water systems project underway. Enterprise-wide risk management project to provide advice to Minister of Health Services. Context document completed, consultation underway.

- Drinking water information management project initiated; cross-government and drinking water private sector partners.
- Improvements underway to health region public health inspection systems to accommodate new requirements of *Drinking Water Protection Act* and regulation.

4.2 Relevant Drinking Water Safety Legislation

Relevant legislation for the Ministry of Health Services are the *Drinking Water Protection Act* (and Drinking Water Protection Regulation) and the *Health Act* (and its Sanitary Regulations, Health Act Communicable Disease Regulation, and Food Premises Regulation).

4.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

The following guidelines and policies support the Action Plan for Safe Drinking Water in British Columbia:

- Regional develop a protocols to follow up on orders.
- Policies and procedures manual (to guide drinking water officers in exercise of their statutory authority under the *Drinking Water Protection Act* and regulation) – *under development*.
- Best practices guidance document (to guide water suppliers to regulatory compliance) – *under development*.

4.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

The Ministry of Health Services has committed a total of $3.6 million this fiscal year, including:

- $2 million allocated on an ongoing basis to health authorities for drinking water officers.
- Funding for a Provincial Drinking Water Officer and support staff added to the Office of the Provincial Health Officer.
- Funding for one Director of Special Projects dedicated to capacity-building position within Health Protection and 80 per cent of Drinking Water Program.
- $100,000 to PHSA/BCCDC to enable enhanced capacity for microbiological monitoring.
- $63,000 for support of small systems project.
- $475,000 for support of the development of the drinking water information management project.
- $200,000 to health authorities for data management needs associated with transition to new legislative framework.
- $125,000 to health authorities for pilot projects related to *Drinking Water Protection Act* assessments.
- $117,000 to BCWWA for the development of a Best Management Practices document.
- $30,000 to policy and procedures manual and education of drinking water officers.
- $14,000 to community stewardship.

4.5 Collaborations with Other Ministries/Health Authorities

The Ministry of Health Services actively collaborates with other ministries and the health authorities. Its specific roles include:

- Lead on ADMCC.
- Lead on Directors' Inter-Ministry Committee on Drinking Water.
- Partner on Drinking Water Leadership Council.
- Partner on Source-to-Tap Assessment Team.
- Consultation on
  - *Forest and Range Practices Act* and regulation.
  - *Environmental Management Act*.
  - *Integrated Pest Management Act*.
  - Fast Track Program.
- Liaison with other provincial jurisdictions through Federal-Provincial-Territorial Committee on Drinking Water.
- Lead on drinking water information management project (2003/2004).

5.0 Ministry of Community, Aboriginal and Women's Services

5.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

The Ministry of Community, Aboriginal and Women's Services was involved in a number of activities in support of the Action Plan for Safe Drinking Water in British Columbia in 2003/2004, including:

- Developing a water conservation plan under the leadership of the Ministry of Water, Land and Air Protection.
- Participating in the land use planning process under the leadership of the Ministry of Sustainable Resource Management.
- Implementing a province-wide data set on public water supply systems under the leadership of the Ministry of Health Services.
- Ensuring flexibility for small systems under the leadership of the Ministry of Health Services.
- Identifying options and implementing appropriate revenue streams.
- Assessing ongoing costs and updating revenue stream for enhanced drinking water protection under the leadership of the Ministry of Health Services.

5.2 Relevant Drinking Water Safety Legislation

Relevant legislation for the Ministry of Community, Aboriginal and Women's Services include the *Local Government Grants Act* and the *Community Charter/Local Government Act*.

5.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

A number of the ministry's guidelines and policies support the Action Plan:

- Support land use planning at the regional and municipal level through:
  - Regional Growth Strategies.
  - Smartgrowth.
  - Smart Development Partnership Program.
- Continued integration of water conservation practices in Local Government Study Grant and capital grant programs.
- Collect municipal and regional district data through the Local Government Information System of the Local Government Statistics Section, Local Government Department.
- Provide support and statutory approvals to improvement districts in the administrative, financial and engineering spheres.
- Provide guidance, tools and advice to local government regarding governance of small, private systems.
- Expansion of the Local Government Grants Program to provide additional planning and study funding to support the *Drinking Water Protection Act*.
- Continued administration of the Canada/British Columbia Infrastructure Program.
- Provide funding for local government infrastructure, including the improvement of public water supply systems.

5.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

Through the Local Government Grants Program, $1 million per fiscal year is dedicated to planning and studies related to water and/or sewer infrastructure. There is a proposed increase to nominal spending through the Local Government Grants Program from $1.0 million to $1.5 million to support additional planning and study. The ministry also continues to administer the Canada/British Columbia Infrastructure Program (see Appendix C), which provides $600 million for "green" infrastructure until March 31, 2006.

5.5 Collaborations with Other Ministries/Health Authorities

The ministry collaborates with other stakeholders, including:

- Local governments.
- BCWWA.
- Smart Growth on the Ground (Maple Ridge project that includes sustainable infrastructure planning, the Water Balance Model and water conservation as part of the planning process).
- The Smart Development Partnership Program (provides local government funding for projects that address sustainable development issues).
- Active participation with the BCWWA Water Sustainability Committee, Regional District of Central Kootenay (research and development guidelines for governance of small public water supply systems within regional district boundaries).
- Health authorities (drinking water projects to ensure health authorities' priorities are addressed).

In addition, all water projects receiving funding under the Canada/British Columbia Infrastructure Program require that water conservation planning be part of project development. The ministry has also developed an *Improvement District Conversion Guide*.

6.0 Ministry of Forests

6.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

The Ministry of Forests protects drinking water sources under legislated mandates.

6.2 Relevant Drinking Water Safety Legislation

On January 31, 2004, the *Forest and Range Practices Act* (FRPA) and its regulations were brought into effect. The Act and regulations set clear objectives and standards that are designed to protect water quality.

Section 149 of FRPA identifies water as one of the values government has set regulations to protect. The protection measures are outlined in the Forest Planning and Practices Regulation, Range Planning and Practices Regulation, and the Woodlot Licence Planning and Practices Regulation. For example, in the Forest Planning and Practices Regulation, anyone carrying out a primary forest activity must ensure the activity does not cause material harmful to human health to be deposited or transported in water being used for human consumption. Road construction must also preserve natural drainage patterns and prevent sediment from being deposited into creeks. People using cattle for silvicultural purposes cannot construct corrals or use livestock in riparian management areas that drain into streams used for potable water or in the riparian management areas of community watersheds. In addition there are specific regulations protecting licensed waterworks. For example, people carrying out a forestry activity must ensure material harmful to human health is not deposited or transported in water used for human consumption. Likewise, there are similar regulations designed to protect water quality in community watersheds. People constructing roads in community watersheds must prevent the entry of sediment into streams, lakes or wetlands if their water is being diverted for human consumption. In addition roads cannot interfere with subsurface flow if it contributes to a spring that is being used as source water for a licensed waterworks. There are also regulations that prevent the use of fertilizers for silvicultural treatments near water sources in community watersheds.

6.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

The ministry has developed numerous guidelines, guidebooks and policies that support the Action Plan. Guidelines and guidebooks that protect and manage water quality and quantity include those for Community Watersheds, Forest Road and Engineering, Riparian Management Areas, Gully Assessment Procedures, Mapping and Assessing Terrain Stability, Range Use, Soil Conservation, Soil Rehabilitation, Watershed Assessment Procedures and the Stream Crossing Guidebook for Fish Streams. In addition the ministry has also developed resource management policies that address the Erosion of Forested Land, Standard Operating Procedures for Forest Service Roads and Pesticide Regulation Use. The ministry is also currently in the process of developing policies

for Soil Conservation, Community Watershed Management, and Repairing Damage to Community Water Supplies and Delivery Systems.

6.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

Ministry staff attend meetings of the Assistant Deputy Ministers' Coordinating Committee on Drinking Water and the Directors' Inter-Ministry Committee on Drinking Water, and develop guidelines and guidebooks.

6.5 Collaborations with Other Ministries/Health Authorities

With respect to water management, protection and conservation, the ministry collaborates with numerous other ministries and health authorities. For example, the ministry consults with the Ministry of Water, Land and Air Protection regarding the application of pesticides, monitoring of water quality and the development of indicators for monitoring stream health. We consult with the Ministry of Sustainable Resource Management to develop strategic land use plans for activities occurring on Crown land, develop water quantity and quality inventories and assist in the development of criteria and indicators to assess water quantity and quality. The ministry also collaborates with the Ministry of Transportation regarding road and bridge construction and the installation of culverts. The Ministry of Forests and the Ministry of Agriculture, Food and Fisheries consult at the provincial level to provide input into each other's legislation. The ministry collaborates with the Ministry of Energy and Mines regarding cutting permits,for seismic and pipeline right of ways.

7.0 Ministry of Sustainable Resource Management

7.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibilities

[No information provided.]

7.2 Relevant Drinking Water Safety Legislation

The Canada-BC Memorandum of Agreement for Water Quantity Surveys (Order in Council No. PC 1975-1/172) provides the structure to ensure that we have critical water quantity (Hydrometric) information required for health and safety, economic development and sustainability of our natural environment.

7.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

None

7.4 Resources Committed to the Action Plan for Safe Drinking Water in British Columbia

The Ministry of Sustainable Resource Management has committed the following resources to the Action Plan for Safe Drinking Water in British Columbia:

- The Assistant Deputy Minister, Land Information Services Division, participates on the Assistant Deputy Ministers' Coordinating Committee on Drinking Water.
- The Director, Information Resource Branch, participates in the Directors' Inter-Ministry Committee on Drinking Water.
- Staff participate in the drinking water information management project working group.
- A "Source to Pipe" contract was managed and supported by the ministry (funded by the Ministry of Health Services). The project looked at the information available in the Land and Resource Data Warehouse related to drinking water and assessed the high-level needs of users requiring data related to drinking water issues.
- Information Management Branch staff provided advice to Ministry of Health Services staff on the overall project.
- The Resources Management Division has responsibility for coordinating the management of the community watersheds portfolio (previously under the Forest Practices Code and currently under the *Forest and Range Practices Act*). This includes designation of the land base,

management of information, mapping (in partnership with Land & Water British Columbia, Inc.) and advice to the Ministry of Forests.

7.5 Collaborations with Other Ministries/Health Authorities

The Ministry of Health Services was directly involved in the progress of the "Source to Pipe" contract, and the Resource Information Branch has been collaborating with the Ministry of Water, Land and Air Protection's River Forecast Centre to ensure watershed and channel assessments are accessible as an information source.

8.0 Ministry of Water, Land and Air Protection

8.1 Action Plan for Safe Drinking Water in British Columbia Tasks/Responsibility

The Ministry of Water, Land and Air Protection is involved in many projects supporting the Action Plan for Safe Drinking Water in British Columbia, including the development of water conservation plans, the implementation of province-wide source-to-tap assessments, the development of new groundwater legislation and enhanced water quality monitoring.

8.2 Relevant Drinking Water Safety Legislation

The following are the pieces of legislation relevant to the Ministry of Water, Land and Air Protection:

- *Environmental Management Act (Waste Management Act)*
- Agricultural Waste Control Regulation
- Contaminated Sites Regulation
- Municipal Sewage Regulation
- Special Waste Regulation
- *Pesticide Control Act*[1]
- *Water Act* and regulations (e.g., Ground Water Protection Regulation)

8.3 Guidelines and Policies in Support of the Action Plan for Safe Drinking Water in British Columbia

The following guidelines and policies support the Action Plan for Safe Drinking Water in British Columbia:

Water Conservation Plan

- Development of Water $ave Tool Kit in partnership with BCWWA's Water Sustainability Committee.
- Water conservation focus group consultation with drinking water utilities and other water use sectors.
- Linkage to Drought Management Action Plan.

Source-to-Tap Assessments

- A series of tools have been developed to assist water suppliers and drinking water officers to meet their obligations for source-to-tap assessments under the *Drinking Water Protection Act*.
- Drinking Water Screening Tool for water suppliers finalized.
- Screening Tool Interpretation Guide for drinking water officers drafted.
- Comprehensive Source-to-Tap Assessment Guideline for water suppliers and professional consultants drafted.
- Assessment Response Plan Template for water suppliers under development.
- Business Process Design for assessments drafted.

Groundwater Protection

- Ground Water Advisory Board work on Phase 2 regulation initiated.
- Planning initiated for Ground Water Protection Regulation implementation: policies and procedures, compliance strategy, database enhancements.
- Well drilling and construction standards brought in under Phase 1 of the Ground Water Protection Regulation.
- Aquifer mapping and characterization (Peace River, Alberni Valley, Kamloops, Gulf Islands).

[1] *This Act was repealed and replaced by the* Integrated Pesticide Management Act *effective December 31, 2004.*

- Regional training and outreach on Ground Water Protection Regulation.

Water Quality Monitoring Network

Network of projects across province that monitor raw water quality for drinking water and protection of aquatic ecosystems. Delivered by regional staff.

- About 250 groundwater wells and 135 surface water supplies that are used as drinking water sources have been sampled.
- Activities include actual sample collection, sample shipping costs, sample analysis costs, data reporting costs and some data assessments leading to proposed water quality objectives.

Other

- Water Quality Guidelines – establish acceptable ranges for specific water quality parameters, (e.g., arsenic) based on the type of use (e.g., drinking or fish habitat).
- Water Quality Objectives – establish water quality objectives for a range of water quality parameters in specific streams (e.g., individual community watersheds) based on monitored results.
- Watershed/water quality assessments (Ministry of Water, Land and Air Protection regions lead).
- Storm Water Management Plans and Liquid Waste Management Plans at the local government level.
- Living Rivers Strategy – An inclusive framework that integrates cross-government-water and watershed-related initiatives.
- Township of Langley Water Management Plan (Ministry of Water, Land and Air Protection lead).

8.4 Resources committed to the Action Plan for Safe Drinking Water in British Columbia

In 2003/2004, the Ministry of Water, Land and Air Protection had a total of 18 full-time equivalent employees working on water issues, including surface and groundwater technical specialists, a policy analyst, monitoring and reporting staff, water technicians, impact assessment biologists, compliance officers, toxic management/emergency response staff and management.

In 2003/2004, the ministry spent a total of $1.6 million on contracts and expenses related to water projects, including the development of Source-to-Tap Assessment Tools and groundwater regulations (Ground Water Advisory Board), aquifer mapping and characterization, development of the Water $ave Tool Kit, support for the regional water quality monitoring network, support for research at the University of Victoria (bacterial source tracking, stable isotopes), groundwater regulation training, an aquifer awareness program and regional watershed projects.

8.5 Collaborations with Other Ministries/Health Authorities

The ministry collaborates extensively with other stakeholders, including the following:

Water Conservation

- Participation on Deputy Ministers' Committee on Drought and Drought Task Force
- Participation in BCWWA Water Sustainability Committee
- Support to BCWWA Water Sustainability Action Plan (including WaterBucket Website Partnership, BC Water Roundtable discussions on water sustainability)..

Source-to-Tap Assessments

- Source-to-Tap Assessment Team and subcommittees.
- Presentations to BCWWA and Water Supply Association of BC.
- Joint meeting between regions and headquarters Ministry of Water, Land and Air Protection, Ministry of Health Services and health authorities.
- Source water protection workshop with regions, Ministry of Health, health authorities.
- Ministry of Water, Land and Air Protection regional staff and health authority partnerships to address source water protection issues in the field.

Groundwater Protection

- Consultation with BC Ground Water Association, industry practitioners, academia.
- Partnership with Geological Survey of Canada to conduct regional aquifer assessment in Okanagan Basin; Okanagan Ground Water Assessment Project.
- Collaboration with Simon Fraser University on aquifer characterization in Grand Forks.
- Collaboration with BCWWA to develop Well Protection Toolkit curriculum for workshop delivery across BC.
- Aquifer Awareness Program.

Information Management

- Participation in drinking water information management project committee.
- Environmental Monitoring System Web Reporting, BC Water Resource Atlas Web Mapping Application, WELL database enhancements, Ground Water National Topographic System Geo-referencing, Ground Water Data Cross-referencing.

Outreach

- Three years funding for BC Lake Stewardship Society to support volunteer lake monitoring by individuals and groups.
- BC Lake Stewardship Society/North American Lake Management Society Conference.

Appendix E: Glossary

4-3-2-1 treatment objective

A treatment train that acheives: 4 log (99.99 per cent) removal or inactivation of viruses, a 3 log (99.9 per cent) removal or inactivation of *Giardia* and *Cryptosporidium* cysts, incorporates 2 treatment barriers (e.g., filtration and disinfection), and achieves turbidity equal to or less than 1 NTU.

Action Plan for Safe Drinking Water in British Columbia

The BC government's comprehensive framework for protecting drinking water supplies and public health. Developed in 2002, the Action Plan is found online at www.health.gov.bc.ca/cpa/publications/safe_drinking_printcopy.pdf

Aquifer

An underground zone or stratum of permeable rock or loose material where water accumulates, and which can yield useful quantities of water to wells or springs.

Certification

See Operator Certification.

Clinical Microbiology Proficiency Testing

The program used to evaluate the performance of water bacteriology laboratories (For more information, please refer to http://www.interchg.ubc.ca/cmpt).

Coliform bacteria

A large group of bacteria, commonly found in topsoil, bodies of water and animal (fecal) material.

Total coliforms: In drinking water, the level of total coliforms indicates whether water has been contaminated from an unsanitary source. It is not used for public health but as an indicator of water quality.

Fecal coliforms: A sub-group of coliforms, found almost exclusively in the intestinal wastes of humans and animals, but capable of growing elsewhere in the environment. If found in water, they are an indicator that it has been contaminated with sewage or other intestinal wastes and may be a potential risk, if containing disease-causing organisms. Water containing fecal coliforms is generally unsafe to drink. See *E. coli*.

Connection

The line from the water main to a dwelling, campsite or premises.

Cryptosporidium

A small (4-6 micrometres in diameter) protozoan parasite with a complex life cycle. The species found most commonly in mammals, *Cryptosporidium parvum*, has the ability to infect a broad range of hosts. Infection of a suitable host species results from ingestion of the parasite in its transmissible stage, the oocyst that is hardy and persists in the environment for weeks. The illness, cryptosporidiosis, consists of watery diarrhea and, occasionally, vomiting. Diarrhea typically lasts for 10-14 days in people and cattle, but may last for several months. No treatment is available.

Disinfection

A water treatment specifically designed to destroy or inactivate pathogenic organisms and thereby prevent waterborne diseases, which are the most significant health risk associated with drinking water. Primary disinfectants are added to water to disinfect it before it enters the water suppliers' distribution system. Secondary disinfectants are used to prevent regrowth of bacteria in the distribution system. The disinfecting agents most commonly used in water treatment today in British Columbia are chlorine and related compounds called chloramines, although there is increasing interest in the use of ozone as a primary disinfectant. Considerations in choosing disinfectants include disinfecting power, cost of use, and effects on taste and odour of drinking water. Minimizing of by-products associated with disinfectant use is also a concern. Some of these by-products are possibly carcinogenic, although research findings are not clear.

Disinfection by-products

Secondary chemicals produced when a disinfectant reacts with organic matter in water. For example, when chlorine is added to water, it reacts with organic matter to form trihalomethanes. Because they are formed from chlorine, trihalomethanes are referred to as "chlorinated disinfection by-products" or CDBPs. If water is treated to remove the organic matter prior to disinfection, such as through filtration, a lesser amount of by-products will be formed.

Distribution system

The pressurized piping system that carries water from a drinking water treatment facility to the premises of consumers.

Drinking water officer

A specialised health professional hired by a regional health authority to implement the *Drinking Water Protection Act* and regulation, as required by the Act. By default, the drinking water officer is the medical health officer, but the latter can delegate his or her duties to another qualified person. For more information on the duties and responsibilities of the drinking water officer, see the *Drinking Water Officer's Guide* online at www.health.gov.bc.ca/protect/dwoguide.pdf

Drinking water protection plans

The Drinking Water Protection Act defines a drinking water protection plan as one approved by the Lieutenant Governor in Council under Section 34 of the Act. For more information, see Part 5 of the Act.

E. coli *(Escherichia coli)*

A type of fecal coliform bacteria whose presence in water indicates recent animal contamination and the possible presence of pathogenic micro-organisms. The test for *E. coli* is the "Gold Standard" method for identifying fecal contamination. Schedules A and B of the Drinking Water Protection Regulation set out the water quality standards and sampling frequencies for potable water. These Schedules include sampling for *E. coli*.

Fecal coliforms

See Coliform bacteria

Freshet

The flood of a river from heavy rain or snow melt.

Giardia

A protozoan parasite found widely in many mammalian intestines. Infection with *Giardia*—an illness called giardiasis, nicknamed, inappropriately, "beaver fever"—can cause diarrhea, abdominal cramps, nausea or vomiting, weight loss and fatigue lasting many weeks. It can be carried by humans as well as by certain domestic and wild animals.

Groundwater

Water found underground in the saturated zone of an aquifer. Groundwater is a source of well water and often surface water (e.g., springs).

Guidelines for Canadian Drinking Water Quality

A comprehensive Canadian compilation of recommended limits for substances and conditions that affect the quality of drinking water, developed by the Federal-Provincial-Territorial Committee on Drinking Water and published by Health Canada. Available online at www.hc-sc.gc.ca/waterquality.

Health hazard

The *Drinking Water Protection Act* defines a drinking water health hazard as a condition or thing in relation to drinking water that endangers public health or prevents or hinders the prevention or suppression of disease. It can also be a prescribed condition or thing that fails to meet a prescribed standard.

Improvement district

Under the *Municipal Act*, a body incorporated by letters patent to provide local services such as water and fire protection to residents within a specified boundary. An improvement district has a locally elected governing body and the power to borrow, charge and regulate the services it provides, but does not have the broad powers granted in legislation to municipalities.

Mandatory standards

The conditions that water quality is legally required to meet in order to be considered potable. In BC, these conditions are set out in Schedules A and B of the Drinking Water Protection Regulation.

Membrane filtration

Membrane filtration is a technique that permits removal of particles from a drinking water source on the basis of their molecular size and shape with the use of pressure and specially designed semi-permeable membranes.

Microbiological pathogen

A disease-causing agent, especially micro-organisms such as viruses, bacteria or protozoa, which can be present in municipal, industrial and non-point source discharges.

Monitoring

A series of observations over time for the purpose of detecting change.

Monitoring requirements

Requirements set out in the Drinking Water Protection Regulation that relate to the sampling, transportation, testing and analysis of drinking water samples.

Multi-barrier approach

An integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health.

Operating permit

A permit issued by a drinking water officer to a drinking water supplier that sets out the terms and conditions that must be respected when operating the system. The terms and conditions may apply to treatment requirements; equipment and operating requirements; the qualifications and training of people operating, maintaining and repairing equipment; monitoring requirements; water quality standards, and reporting requirements. The requirements may be more stringent than those set out in the Act and regulation. If the supplier fails to meet the terms and conditions, the operating permit may be revoked.

Operational failure

A breakdown of equipment or processes in the treatment or distribution of drinking water.

Operator certification

The process of establishing that a water treatment or distribution operator has the appropriate experience, training, knowledge and skills to run the type of drinking water system on which they work. Water systems are rated by level of complexity; operators are certified to corresponding levels. In BC, operator certification is done through the Environmental Operators Certification Program.

Potable water

Water fit for human consumption.

Public water supply system

Under the *Drinking Water Protection Act* and regulation, any drinking water system that serves more than one single family residence is considered a "water supply system." Public water supply system has been used in this report to ensure that readers are aware that supplies serving one single family dwelling are not being discussed.

Small water system

Water system serving fewer than 500 people.

Source to tap

A way of looking at the entire water supply system, from the source water in a watershed through the treatment and distribution systems to the point at which it reaches the consumer.

Source water

The body of water from which a drinking water supply originates. Source waters can be surface water or groundwater supplies.

Surface water

The Drinking Water Protection Regulation defines surface water as water from a source which is open to the atmosphere, including streams, lakes, rivers, creeks and springs. Drinking water originating from a surface water source, or a groundwater source that may be under the influence of surface water and is therefore at risk of being contaminated by pathogens, must be disinfected.

System assessment

The process and results of identifying, inventorying and assessing a drinking water source (including the land uses and other activities and conditions that may affect it), the treatment and operation of the drinking water supply system, the monitoring requirements for the source and system, and the threats to drinking water from source to tap.

Total coliforms

See Coliform bacteria.

Turbidity

Cloudiness or haziness in water, usually due to suspended particles of silt or clay. Such particles affect the quality of drinking water by interfering with disinfection and impairing the appearance of the water.

Water distribution system

See Distribution system.

Water license

A license, issued under the *Water Act*, which entitles its holder to:

- divert and use, for the purpose and during the time stipulated, the quantity of surface water specified in the licence;
- store surface water;
- construct, maintain and operate the works authorized under the license and necessary for the proper use of the water, or of power produced from it; and
- alter or improve a stream or channel.

Watershed

The entire area drained by a waterway, or that drains into a lake or reservoir. Also called catchment basin, or catchment area.

Appendix F: Acronyms and Initialisms

ABC	Association of Boards of Certification
ADMCC	Assistant Deputy Ministers' Coordinating Committee on Drinking Water
AWWA	American Water Works Association
BC	British Columbia
BCCDC	British Columbia Centre for Disease Control
BCWWA	British Columbia Water & Waste Association
BMPG	Best Management Practices Guideline
BWA	Boil water advisory
CDW	Federal-Provincial-Territorial Committee on Drinking Water
CIHR	Canadian Institutes of Health Research
CRD	Capital Regional District
CWN	Canadian Water Network
DWLC	Drinking Water Leadership Council
DWO	Drinking Water Officer
DWPA	*Drinking Water Protection Act*
DWPR	Drinking Water Protection Regulation
EFP	Environmental Farm Planning
EHO	Environmental Health Officer
EOCP	Environmental Operators Certification Program
EWQA	Enhanced Water Quality Assurance Program
FTE	Full-time equivalent
GVRD	Greater Vancouver Regional District
HA	Health Authority
INAC	Indian and Northern Affairs Canada
MAC	Maximum Acceptable Concentration
MAFF	Ministry of Agriculture, Food and Fisheries
MEM	Ministry of Energy and Mines
MHO	Medical Health Officer
MHS	Ministry of Health Services
MCAWS	Ministry of Community, Aboriginal and Women's Services
MOT	Ministry of Transportation
MSRM	Ministry of Sustainable Resource Management
MWLAP	Ministry of Water, Land and Air Protection
PHO	Provincial Health Officer
QAWG	Quality Assurance Working Group
SWS	Small Water System
US EPA	United States Environmental Protection Agency
WD	Water Distribution
WT	Water Treatment

Appendix G: Government Ministries (new names)

In 2003/2004:

Ministry of Agriculture, Food and Fisheries

Ministry of Community, Aboriginal and Women's Services

Ministry of Energy and Mines

Ministry of Forests

Ministry of Health Services

Ministry of Sustainable Resource Management**

Ministry of Water, Air and Land Protection

In 2004/2005:

Ministry of Agriculture and Lands*

Ministry of Community Services

Ministry of Energy, Mines and Petroleum Resources

Ministry of Forests and Range

Ministry of Health

Ministry of Small Business and Revenue

Ministry of Environment

* Some responsibities of the Ministry of Agriculture and Lands were transferred from the Ministry of Sustainable Resource Management.

** Some of the responsibilities of the Ministry of Sustainable Resource Management were transferred to the Ministries of Agriculture and Lands and Environment.

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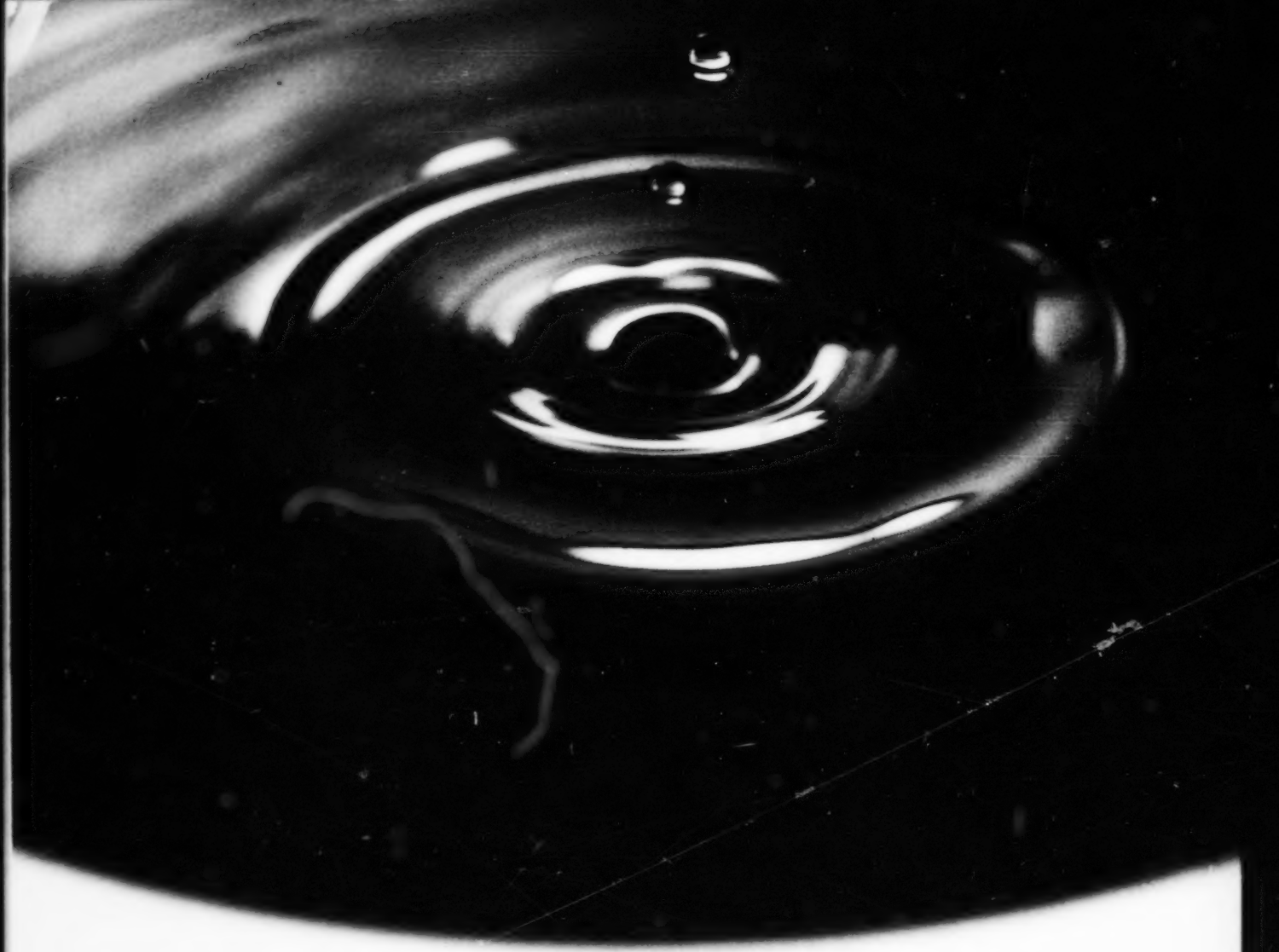

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